Clouds and the Earth's Radiation Energy System (CERES) Bidirectional Scans (BDS) Collection Document

CERES logo goes here

Summary

The Clouds and the Earth’s Radiant Energy System (CERES) is a key component of the Earth Observing System (EOS). The CERES instrument provides radiometric measurements of the Earth's atmosphere from three broadband channels: a shortwave channel (0.3 - 5.0 microns), a total channel (0.3 - 100mm), and an infrared window channel (8-12mm). The CERES instruments are improved models of the Earth Radiation Budget Experiment (ERBE) scanner instruments, which operated from 1984 through 1990 on the National Aeronautics and Space Administration’s (NASA) Earth Radiation Budget Satellite (ERBS) and on the National Oceanic and Atmospheric Administration’s (NOAA) operational weather satellites NOAA-9 and NOAA-10. The strategy of flying instruments on Sun-synchronous, polar orbiting satellites, such as NOAA-9 and NOAA-10, simultaneously with instruments on satellites that have precessing orbits in lower inclinations, such as ERBS, was successfully developed in ERBE to reduce time sampling errors. CERES continues that strategy by flying instruments on the polar orbiting EOS platforms simultaneously with an instrument on the Tropical Rainfall Measuring Mission (TRMM) spacecraft, which has an orbital inclination of 35 degrees. The CERES instruments fly on the TRMM spacecraft, the EOS-AM platforms, and on the EOS-PM platforms. The TRMM satellite carries one CERES instrument while the EOS satellites carry two CERES instruments, one operating in a fixed azimuth scanning mode for continuous Earth sampling and the other operating in a rotating azimuth scanning mode (RAPS) for improved Angular Directional Models.

To preserve historical continuity, some parts of the CERES data reduction use algorithms identical with the algorithms used in ERBE. At the same time, many of the algorithms on CERES are new. To reduce the uncertainty in data interpretation and to improve the consistency between the cloud parameters and the radiation fields, CERES includes cloud imager data and other atmospheric parameters. The CERES investigation is designed to monitor the top-of-atmosphere radiation budget as defined by ERBE, define the physical properties of clouds, define the surface radiation budget, and determine the divergence of energy throughout the atmosphere. The CERES Data Management System produces products which support research to increase understanding of the Earth’s climate and radiant environment.

The Bidirectional Scans (BDS) data product contains twenty-four hours of Level-1B data for each CERES scanner mounted on each spacecraft. The scanner instrument consists of three broadband radiometric channels: shortwave, window, and total. All science scan modes are in the BDS: the fixed and rotating azimuth scan modes that perform normal Earth scans, internal and solar calibration, and short scan elevation profiles. The BDS product includes samples taken at all scan elevation positions (including space-looks and internal calibration views).

The BDS includes the raw (unconverted) science and instrument data from the Level 0 input file

(excluding Level 0 header and footer data) as well as the geolocated converted science and instrument data. The BDS also contains additional data not found in the Level 0 input file, including converted satellite position and velocity data, celestial data, converted digital status data, and parameters used in the radiance count conversion equations. This document provides information which describes the BDS collection for all CERES instruments.

Table of Contents

1.0 Collection Overview

1.1 Collection Identification

The BDS filename is

CER_ BDS_Sampling-Strategy_Production-Strategy_XXXXXX.YYYYMMDD where

Sampling-Strategy defines the platform (e.g., TRMM-PFM)
Production-Strategy defines the edition or campaign (e.g., At-launch-Edition)
XXXXXX is a configuration code used for file and software versioning management
YYYY is a 4-digit year integer,
MM is a 2-digit month integer, and
DD is a 2-digit day integer which defines the data acquisition date.

1.2 Collection Introduction

The Bidirectional Scan (BDS) data product is an archival product containing both Level-0 and Level-1b CERES scanner data obtained for a 24-hour period.

1.3 Objective/Purpose

The science objectives of the CERES investigation are

1. For climate change analysis, provide a continuation of the ERBE (Earth Radiation Budget Experiment) record of radiative fluxes at the top of the atmosphere (TOA) analyzed using the same techniques as the existing ERBE data.
2. Double the accuracy of estimates of radiative fluxes at the TOA and the Earth's surface.
3. Provide the first long-term global estimates of the radiative fluxes within the Earth's atmosphere.
4. Provide cloud property estimates which are consistent with the radiative fluxes from surface to TOA.

A high-level view of the CERES Data Management System (DMS) is illustrated by the CERES Top Level Data Flow Diagram shown in Figure 1-1. Circles in the diagram represent algorithm processes which are called subsystems. Subsystems are a logical collection of algorithms which together convert input products into output products. Boxes represent archival products. Two parallel lines represent data stores which are designated as nonarchival or temporary data products. Boxes or data stores with arrows entering a circle are input sources for the subsystem, while boxes or data stores with arrows exiting the circles are output products.

The BDS collection is produced by Subsystem 1.0, Geolocate and Calibrate Earth Radiances, to provide geolocated filtered radiance at satellite altitude along with unconverted science and instrument data. The BDS is an archival and validation product used by the Instrument Working Group to validate algorithm and instrument performance. A post-processing program extracts a subset of BDS parameters for input to the ERBE-like Subsystem 2.0. The ERBE-like file is called Pre-ES8 and contains all of the ES8 parameters except scene identification and flux parameters.

1.4 Summary of Parameters

The BDS collection provides the following parameters which are described in detail in the Data Description Section 4.0:

- Unconverted and converted radiance data
- Unconverted and converted instrument data
- Satellite-Celestial data
- Quality assessment information

1.5 Discussion

The CERES Instrument Subsystem (SS1.0) is the first data processing unit in the CERES Data Management System. The primary input data set is a 24-hour Level-0 instrument data stream of chronologically ordered data packets containing a full 6.6 second scan cycle of measurement data from the three broadband radiometric channels, shortwave, window, and total. The radiance

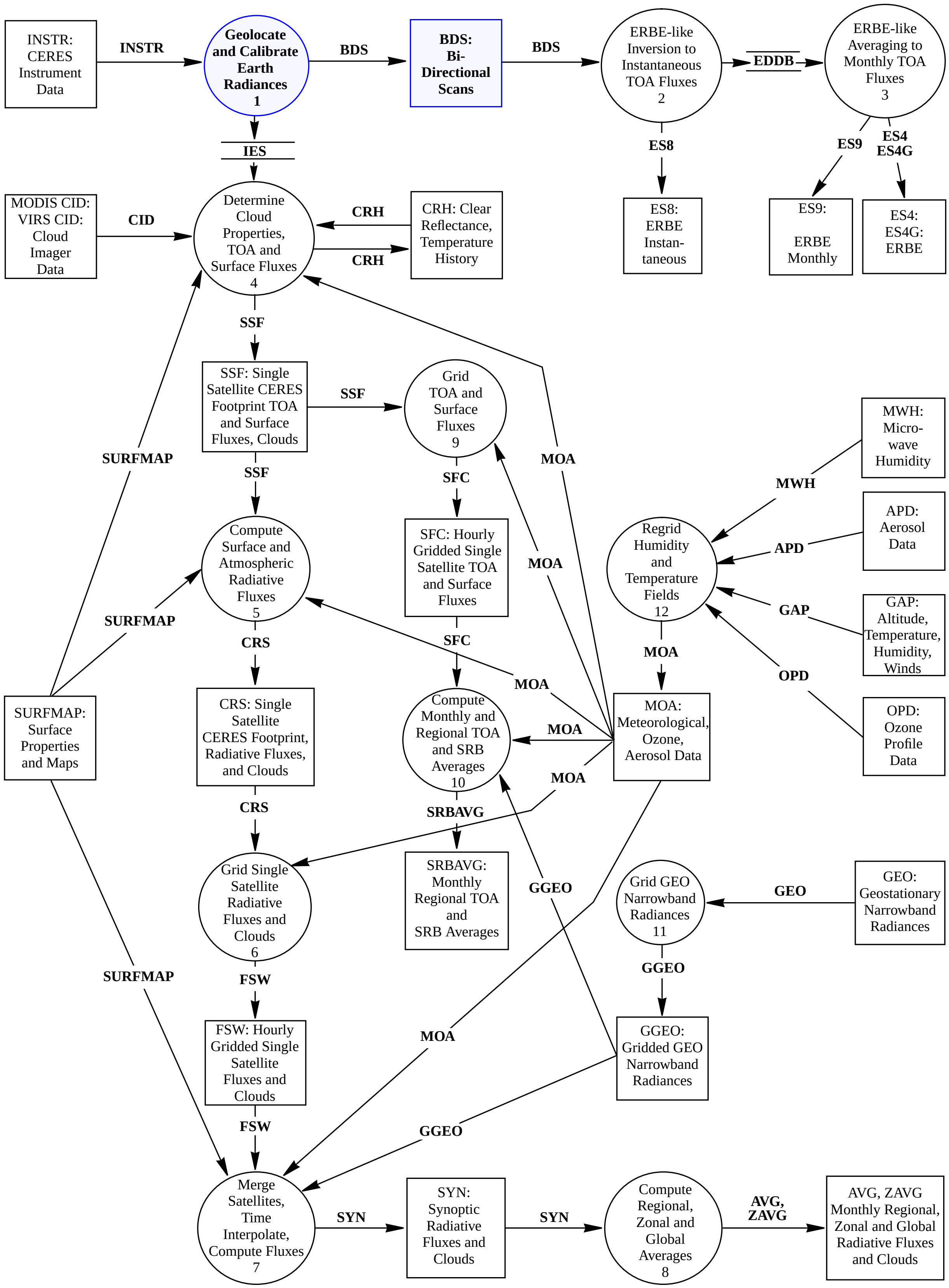

Figure 1-1. CERES Top Level Data Flow Diagram

measurements are sampled and output every 0.01 second while housekeeping data are sampled at least once in each scan cycle. In addition to the radiance data, basic engineering data provided by the CERES instrument package are elevation and azimuth positions, voltage and temperature measurements, and instrument status information. The Level-0 data are contained in three distinct data files that are organized by Application Identifiers (APIDs) in no more than 24-hour segments. The types of data are science (APID = 54), solar calibration (APID = 55), and diagnostic (APID=56) which are collected from the various elevation scan modes in which the instrument can operate. The detectors can also rotate in the azimuth plane or operate at a fixed azimuth angle, such as cross-track. A BDS product is produced for each APID containing all measurements for the APID type.

SS1.0 converts the raw Level-0 CERES digital count data into geolocated and calibrated filtered radiances for the three spectral channels. The Level-0 orbit ephemeris and spacecraft attitude data along with the elevation and azimuth positions are used to compute the geolocation of the science measurements. SS1.0 also converts all instrument and spacecraft engineering data into engineering units.

The accuracy goal for calibrated radiances is 1.0% for shortwave, 0.3% for window, and 0.5% for total channels for scene levels greater than 100 $Wm^{-2} sr^{-1}$. The conversion equations, coefficients, offsets, and any correction adjustments are determined by the CERES Science Team and the instrument builder, TRW, based on pre-launch ground test data and initial in-orbit instrument checkout results. SS1.0 also produces an internal product, IES, that contains only the science APID data and from either a fixed azimuth or a rotating azimuth plane scan. The BDS contains 660 radiance measurements per scan whereas the IES only contains Earth-viewing measurements.

1.6 Related Collections

The CERES DMS produces science data products or collections for use by the CERES Science Team, the Data Management Team, and for archival at the Langley Distributed Active Archive Center (DAAC). For a complete list of products, see the CERES Data Products Catalog (Reference 1).

1.7 Included Collections

BDS products are produced for each instrument on each satellite using the same software.

2.0 Investigators

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2.1 Title of Investigation

Clouds and the Earth's Radiant Energy System (CERES).

2.2 Contact Information

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3.0 Origination

The CERES data originate from CERES instruments on-board either the TRMM or the EOS Earth-orbiting spacecraft. Table 3-1 lists the CERES instruments along with their host satellites.

Table 3-1. CERES Instruments

Satellite	CERES Instrument	
TRMM	Prototype Flight Model (PFM)	
EOS-AM1	Flight Model 1 (FM1)	Flight Model 2 (FM2)
EOS-PM1	Flight Model 3 (FM3)	Flight Model 4 (FM4)

3.1 Sensor and Instrument Description

The CERES instrument package contains three scanning thermistor bolometer radiometers classified by their broad-band spectral regions: total, window, and shortwave. The detectors measure the radiation in the near-visible through far-infrared spectral region. The shortwave detector measures Earth-reflected solar radiation in the wavelength region of 0.3 to 5.0 microns; the window detector measures Earth-emitted longwave radiation in the water vapor window wavelength region of 8.0 to 12.0 microns; and the total detector measures radiation in the range of 0.3 to 100 microns. The detectors are coaligned and mounted on a spindle that rotates about the instrument elevation axis. The field of view footprints of the CERES detectors are approximately 10- and 20-km at nadir for the instruments on the TRMM and EOS spacecraft, respectively.

The CERES instrument has an operational scanning cycle of 6.6 seconds and various scan elevation profiles. Radiometric measurements are sampled from the detectors every 0.01 seconds in all scanning profiles. The instrument makes Earth science measurements while the detectors rotate in the vertical (elevation scan) and horizontal (azimuth rotation). The instrument has built-in calibration sources for performing in-flight calibrations, and can also be calibrated by measuring solar radiances reflected by a solar diffuser plate into the instrument field of view. See the CERES Algorithm Theoretical Basis Document (ATBD) for Subsystem 1.0 (Reference 2). Also, see the instrument, the sensor, and the platform Guides (TBD).

4.0 Data Description

4.1 Spatial Characteristics

4.1.1 Spatial Coverage

The BDS collection is a global data set whose spatial coverage depends on the satellite orbit as shown in Table 4-1. A BDS is produced for each APID received each day throughout the life of the TRMM and EOS missions (See Table 4-1). The BDS contains multiple orbital swaths of CERES footprint data.

Table 4-1. CERES Spatial Coverage

Spacecraft	Minimum Latitude (deg)	Maximum Latitude (deg)	Minimum Longitude (deg)	Maximum Longitude (deg)	Spacecraft Altitude (km)
TRMM	-52.00	52.00	-180.00	180.00	350
EOS-AM1	-90.00	90.00	-180.00	180.00	705
EOS-PM1	-90.00	90.00	-180.00	180.00	705

4.1.2 Spatial Coverage Map

[Product Specific Information - use postage stamp size images that links to full-sized images - recommendation from DAAC]

4.1.3 Spatial Resolution

Each BDS record represents 660 CERES measurement or footprint data. The spatial scale of each footprint varies with the viewing zenith of the scanner. At nadir, the half-power point of the footprint is approximately 10- and 20-km for the instruments on the TRMM and EOS spacecraft, respectively. As the footprint approaches the limb of the Earth, that size increases to about 62 and 125 km respectively.

4.2 Temporal Characteristics

4.2.1 Temporal Coverage

CERES temporal coverage begins at different times depending upon when the spacecraft is launched, when the scan covers are opened after launch, and when early in-orbit calibration check-out is completed (See Table 4-2). Archival science products will be produced beginning with the next complete month of data.

Table 4-2. CERES Temporal Coverage

Spacecraft	Launch Date	Start Date
TRMM (PFM)	11/27/1997	1/1/98
EOS-AM: FM1 & FM2	Expected 06/30/1998	TBD
EOS-PM: FM3 & FM4	Expected 12/30/2000	TBD

4.2.2 Temporal Resolution

One to three BDS products, depending on which APIDs are in the instrument command sequence, are produced for each CERES instrument for each day throughout the life of the TRMM and EOS mission, producing a continuous global data collection. Each BDS footprint within a record represents a radiometric measurement taken every 0.01 seconds and each record covers 6.6 seconds.

4.3 Data Characteristics

4.3.1 Parameter/Variable

BDS Metadata

The BDS has several kinds of metadata, each of which contain information which need only be recorded once per product. Table 4-3 summarizes the BDS metadata.

Table 4-3. BDS Metadata Summary

HDF Name	Description Table	Records	Number of Fields
CERES Baseline Header Metadata	Table A-1	1	36
CERES_metadata Vdata	Table A-2	1	14
BDS Product Specific Metadata	Table 4-4	1	11
Total Size (MB)			

The CERES metadata are listed in Table A-1 and Table A-2 in Appendix A. Table A-1 lists the CERES Baseline Header Metadata and Table A-2 lists the parameters in the Vdata Metadata Table. Note that the Vdata Metadata is a subset of the CERES Baseline Header Metadata. In addition, there are BDS product specific attribute metadata parameters that are listed in Table 4-4.

Table 4-4. BDS Product Specific Attribute (PSA) Metadata

Item	Parameter Name	Units	Range	Data Type
PSA-1	ScanMode	N/A	Raps Only, Faps Only, Raps/Faps	s(20)
PSA-2	Second Time Constant Mode	N/A	Off, On	s(3)
PSA-3	Ephemeris Data Used	N/A	Real, Pred, Sim	s(4)
PSA-4	Attitude Data Used	N/A	Real, Sim	s(4)
PSA-5	Percent Total Channel Bad	N/A	0.0 .. 100.0	F11.6
PSA-6	Percent Window Channel Bad	N/A	0.0 .. 100.0	F11.6
PSA-7	Percent Short Wave Channel Bad	N/A	0.0 .. 100.0	F11.6
PSA-8	Percent FAPS	N/A	0.0 .. 100.0	F11.6
PSA-9	Percent RAPS	N/A	0.0 .. 100.0	F11.6
PSA-10	NumberInputFiles	N/A	0 .. n	U32Int
PSA-11	TOA_Model_Used	N/A	CERES-TOA	s(9)
Record Size (bytes)				92

Product Specific Attribute metadata definitions:

PSA-1 Scan Mode

Instrument Scan Mode

PSA-2 Second Time Constant Mode

Second Time Constant Numerical Filter Applied

PSA-3 Ephemeris Data Used

Type of Ephemeris Data Used

PSA-4 Attitude Data Used

Type of Attitude Data Used

PSA-5 Percent Total Channel Bad

Percent of Total Radiance Samples Marked Bad

PSA-6 Percent Window Channel Bad

Percent of Window Radiance Samples Marked Bad

PSA-7 Percent Short Wave Channel Bad

Percent of ShortWave Radiance Samples Marked Bad

PSA-8 Percent FAPS

Percent of Samples in FAPS mode

PSA-9 Percent RAPS

Percent of Samples in RAPS mode

PSA-10 NumberInputFiles

PSA-11 TOA_Model_Used

Earth Model Used

BDS Vdata

The BDS product contains HDF Vdata structures which are collections of records similar to records used in conventional database applications (multifield, various data types). Each of the Vdatas contains *n* records of packet level data, and there is a one-to-one correspondence of the Vdata record numbers to the row numbers of the BDS SDSs.

Table 4-5 summarizes the contents of each Vdata contained within the BDS file. The detailed parameter descriptions are found in the tables listed in the Description Table column in Table 4-5. There is only one data desciption for those BDS parameters which are included in both raw count values and in their corresponding converted values. Each of these raw/converted parameters are cross referenced to a single description.

Table 4-5. BDS Science/Solar Calibration/Diagnostic No-ArchiveVdata Summary (Sheet 1 of 2)

Item	Vdata Name	Description Table	Records	Number of Fields	Record Size (bytes)	Nominal Size (MB)
Vdata-1	Temperature Counts	Table 4-25	n	39	450	5.62
Vdata-2	Voltage and Torque Counts	Table 4-26	n	24	180	2.25
Vdata-3	Position Counts	Table 4-27	n	12	528	6.6

Table 4-5. BDS Science/Solar Calibration/Diagnostic No-ArchiveVdata Summary (Sheet 2 of 2)

Item	Vdata Name	Description Table	Records	Number of Fields	Record Size (bytes)	Nominal Size (MB)
Vdata-4	Converted Temperatures	Table 4-28	n	35	708	8.84
Vdata-5	Converted Voltages and Torques	Table 4-29	n	23	348	4.35
Vdata-6	Satellite-Celestial Data	Table 4-30	n	11	128	1.6
Vdata-7	Converted Digital Data	Table 4-31	n	25	80	1.1
Vdata-8	Count Conversion Constants	Table 4-34				
	Vdata TOTAL SIZE					**30.36**

* Assumes n = 13091 and does not take into account additional HDF overhead

VDATA TABLE DESCRIPTIONS

Vdata-1 Temperature Counts (RTD) - This data set contains the raw count values for instrument temperature parameters, copied from the level-0 input data files.

Vdata-2 Voltage and Torque Counts (RVTD) - This data set contains the raw count values for instrument voltage, current, and gimbal torque parameters, copied from the level-0 input data files.

Vdata-3 Position Counts (RPC) - This data set contains the raw count values for instrument gimbal, covers, and solar position parameters, copied from the level-0 input data files.

Vdata-4 Converted Temperatures (CTD) - This data set contains the converted values (typically degrees C) for instrument temperature parameters that have defined conversion algorithms.

Vdata-5 Converted Voltages and Torques (CVTD) - This data set contains the converted values for instrument voltage, current, and gimbal torque parameters that have defined conversion algorithms.

Vdata-6 Satellite-Celestial Data (SCD) - This data set contains spacecraft and celestial converted values.

Vdata-7 Converted Digital Data (CDD) - This data set contains the converted values for instrument status parameters that have defined conversion algorithms. Packet information status that are not part of the raw digital status data block are also included in this data set.

Vdata-8 Count Conversion Constants (CCC)- This data set contains values that are used in various computations such as the radiometric count conversion algorithms for computing the radiances included in this data product.

4.3.2 Variable Description/Definition

BDS Scientific Data Sets

Every Scientific Data Set (SDS) in the BDS file represents a time ordered collection of data where each row in the SDS corresponds to a packet of data, and each column corresponds to a single sample within a packet. Most of the SDSs have 660 samples per packet of a single parameter arranged as shown in the following sketch shown in Figure 4-1. (Note: n = the number of packets processed.)

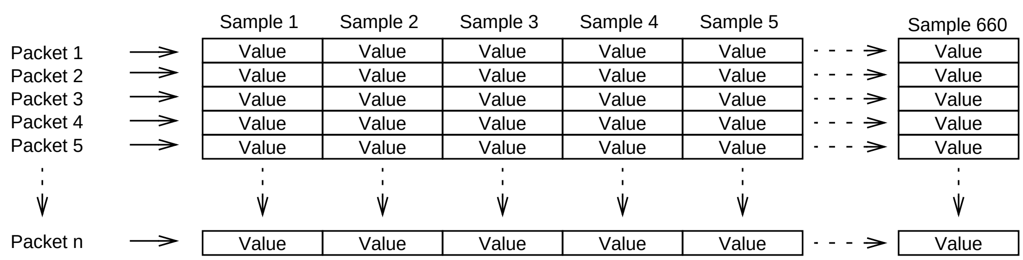

Figure 4-1. BDS SDS schematic

Table 4-6 lists the parameters that are stored as SDSs. The entries in the Link column are hyper-linked to a short definition of the parameter. Any parameter that consists of further decompostion will list the detailed table number in the Range column.

Instrument parameter value ranges or default values referenced throughout this document are based on the actual on-board instrument flight software. Where values differ between this document and referenced documents, this document takes precedence.

Table 4-6. BDS SDS Summary

Link	SDS Name	HDF Rank	Num Row	Num Col -umn	Data Type	Range	Units	Nominal Size (MB)*
BDS-1	Shortwave Detector Output	2	n	660	U16 Integer	0..4095	count	16.45
BDS-2	Total Detector Output	2	n	660	U16 Integer	0..4095	count	16.45
BDS-3	Window Detector Output	2	n	660	U16 Integer	0..4095	count	16.45
BDS-4	Elevation Position Count	2	n	660	U16 Integer	0..4095	count	16.45
BDS-5	Azimuth Position Count	2	n	660	U16 Integer	0..4095	count	16.45
BDS-6	BDS Raw Digital Status Measurement	2	n	185	U16 Integer	Table 4-18	N/A	4.62
BDS-7	CERES SW Filtered Radiance, Upwards	2	n	660	32-Bit Float	-10.0..510.0	$Wm^{-2}sr^{-1}$	32.96
BDS-8	CERES TOT Filtered Radiance, Upwards	2	n	660	32-Bit Float	0.0..700.0	$Wm^{-2}sr^{-1}$	32.96
BDS-9	CERES WN Filtered Radiance, Upwards	2	n	660	32-Bit Float	0.0..50.0	$Wm^{-2}sr^{-1}$	32.96
BDS-10	Colatitude of CERES FOV at TOA	2	n	660	32-Bit Float	0.0..180.0	deg	32.96
BDS-11	Longitude of CERES FOV at TOA	2	n	660	32-Bit Float	0.0..360.0	deg	32.96
BDS-12	CERES Viewing Zenith at TOA	2	n	660	32-Bit Float	0.0..90.0	deg	32.96
BDS-13	CERES Solar Zenith at TOA	2	n	660	32-Bit Float	0.0..180.0	deg	32.96
BDS-14	CERES Relative Azimuth at TOA	2	n	660	32-Bit Float	0.0..360.0	deg	32.96
BDS-15	Converted Elevation Angles	2	n	660	32-Bit Float	0.0..180.0	deg	32.96

Table 4-6. BDS SDS Summary

Link	SDS Name	HDF Rank	Num Row	Num Col -umn	Data Type	Range	Units	Nominal Size (MB)*
BDS-16	Converted Azimuth Angles	2	n	660	32-Bit Float	0.0..270.0	deg	32.96
BDS-17	Radiance and Mode Flags	2	n	660	U32 Integer	Table 4-11	N/A	32.96
BDS-18	Ancillary QA Flags Set 1	2	n	660	U32 Integer	Table 4-12	N/A	32.96
BDS-19	Ancillary QA Flags Set 2	2	n	660	U32 Integer	Table 4-13	N/A	32.96
BDS-20	Julian Date and Time	2	n	2	64-Bit Float	N/A	day	0.20
BDS-21	Cone Angles	2	n	660	32-Bit Float	0.0 .. 90.0	deg	32.96
BDS-22	Clock Angles	2	n	660	32-Bit Float	0.0 .. 360.0	deg	32.96
BDS-23	Cone Angle Rates	2	n	660	32-Bit Float	-100.0 .. 100.0	deg sec^{-1}	32.96
BDS-24	Clock Angle Rates	2	n	660	32-Bit Float	-10.0 .. 10.0	deg sec^{-1}	32.96
BDS-25	SW Spaceclamp Values	2	n	2	32-Bit Float	N/A	count	0.1
BDS-26	WN Spaceclamp Values	2	n	2	32-Bit Float	N/A	count	0.1
BDS-27	Total Spaceclamp Values	2	n	2	32-Bit Float	N/A	count	0.1
BDS-28	Count Conversion SW Sample Offsets	2	n	660	32-Bit Float	N/A	count	0.01
BDS-29	Count Conversion WN Sample Offsets	2	n	660	32-Bit Float	N/A	count	0.01
BDS-30	Count Conversion Total Sample Offsets	2	n	660	32-Bit Float	N/A	count	0.01
	SDS TOTAL SIZE (* assumes n = 13091 and does not include HDF overhead)							581.8

SDS SUMMARY DESCRIPTIONS For the Science, Solar Calibration, and Diagnostic No-Archive BDSs:

BDS-1 Shortwave Detector Output -

This data structure contains the raw shortwave detector count values, copied from the input level-0 data files. There are three frequency sensitive radiometric channels on the CERES scanning instrument; total, longwave/window, and shortwave. The CERES shortwave detector measurement at satellite altitude has a range of 0 - 4095 counts. The CERES algorithm for converting raw radiometric data in digital counts into filtered radiance is in the section on calibration (see Calibration Processing Concepts and "Instantaneous" Blackbody Scanner Offset Calibrations (ICAL's).)

BDS-2 Total Detector Output -

This data structure contains the raw total detector count values, copied from the input level-0 data files. There are three frequency sensitive radiometric channels on the CERES/TRMM scanning instrument; total, longwave/window, and shortwave. The CERES total channel measurement at satellite altitude has a range of 0 - 4095 counts. For further information on calibration, see Calibration Processing Concepts and "Instantaneous" Blackbody Scanner Offset Calibrations

(ICAL's).

BDS-3 Window Detector Output -

This data structure contains the raw window (longwave) detector count values, copied from the input level-0 data files. There are three frequency sensitive radiometric channels on the CERES/TRMM scanning instrument; total, longwave/window, and shortwave. The CERES longwave//window measurement at satellite altitude has a range of 0 - 4095 counts . The CERES algorithm for converting raw radiometric data in digital counts into filtered radiance is in the section on calibration (see Calibration Processing Concepts and "Instantaneous" Blackbody Scanner Offset Calibrations (ICAL's).)

BDS-4 Elevation Positions -

This data structure contains the raw elevation gimbal position count values, copied from the input level-0 data files. See Figure 4-3 for an illustration of the CERES elevation profiles.

BDS-5 Azimuth Positions -

This data structure contains the raw azimuth gimbal position count values, copied from the input level-0 data files. Figure 4-2 illustrates the synchronous and asynchronous profiles.

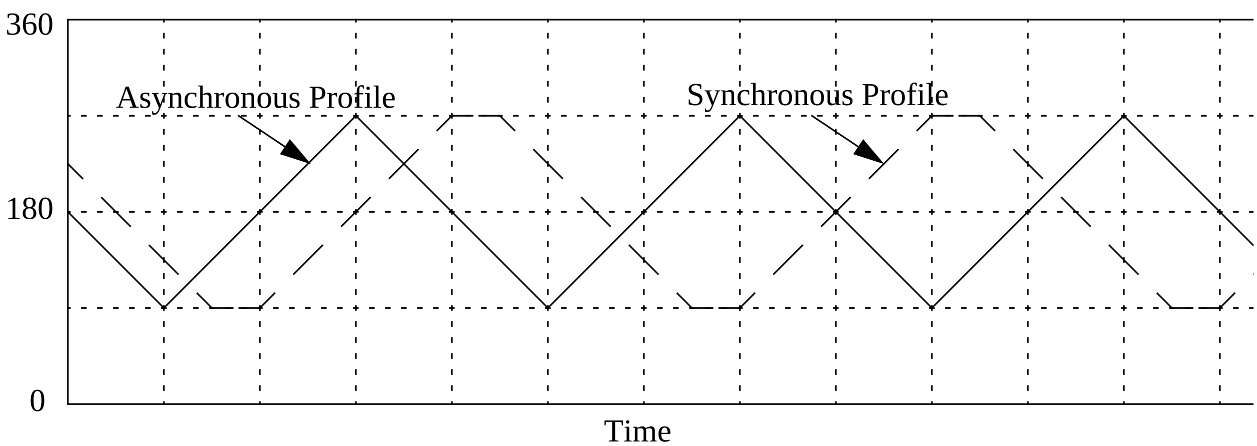

Figure 4-2. Azimuth Scan Profiles

BDS-6 BDS Raw Digital Status Measurement (RDSM) -

This data structure contains the block of status data for each packet, copied from the input level-0 data files. See Table 4-18 for details.

BDS-7 CERES SW Filtered Radiance, Upwards -

This data structure contains the converted shortwave radiance values. Values that could not be computed are set to the CERES defined default value.

BDS-8 CERES TOT Filtered Radiance, Upwards -

This data structure contains the converted total radiance values. Values that could not be computed are set to the CERES defined default value.

BDS-9 CERES WN Filtered Radiance, Upwards -

This data structure contains the converted window radiance values. Values that could not be computed are set to the CERES defined default value.

BDS-10 Colatitude of CERES FOV at TOA -

This data structure contains the colatitude value for each radiance whose FOV that completely fall on the TOA spheroid. (See description on how the FOV is defined.) Values that are partially on, or above, the TOA spheroid are set to the CERES defined default value.

BDS-11 Longitude of CERES FOV at TOA -

This data structure contains the longitude value for each radiance whose FOV that completely fall on the TOA spheroid. (See description on how the FOV is defined.) Values that are partially on, or above, the TOA spheroid are set to the CERES defined default value.

BDS-12 CERES Viewing Zenith at TOA -

This data structure contains the Viewing Zenith value for each radiance whose FOV that completely fall on the TOA spheroid. (See description on how the FOV is defined.) Values that are partially on, or above, the TOA spheroid are set to the CERES defined default value.

BDS-13 CERES Solar Zenith at TOA -

This data structure contains the Solar Zenith value for each radiance whose FOV that completely fall on the TOA spheroid. Values that are partially on, or above, the TOA spheroid are set to the CERES defined default value.

BDS-14 CERES Relative Azimuth at TOA -

This data structure contains the Relative Azimuth value for each radiance whose FOV that completely fall on the TOA spheroid. Values that are partially on, or above, the TOA spheroid are set to the CERES defined default value. (See description on how the FOV is defined.)

BDS-15 Converted Elevation Angles -

This data structure contains the converted elevation gimbal position degree values. No adjustment for Point Spread Function lags or any other instrument or science factors have been made to these values. See Figure 4-3 for an illustration of the CERES elevation profiles. These figures are not drawn to an accurate scale. Table 4-7 through Table 4-10 list the various scan elevation profiles.

BDS-16 Converted Azimuth Angles -

This data structure contains the converted azimuth gimbal position degree values. No adjustment for Point Spread Function lags or any other instrument or science factors have been made to these values. (See description on how the FOV is defined.) Figure 4-2 illustrates the synchronous and asynchronous profiles. This figure is not drawn to an accurate scale.

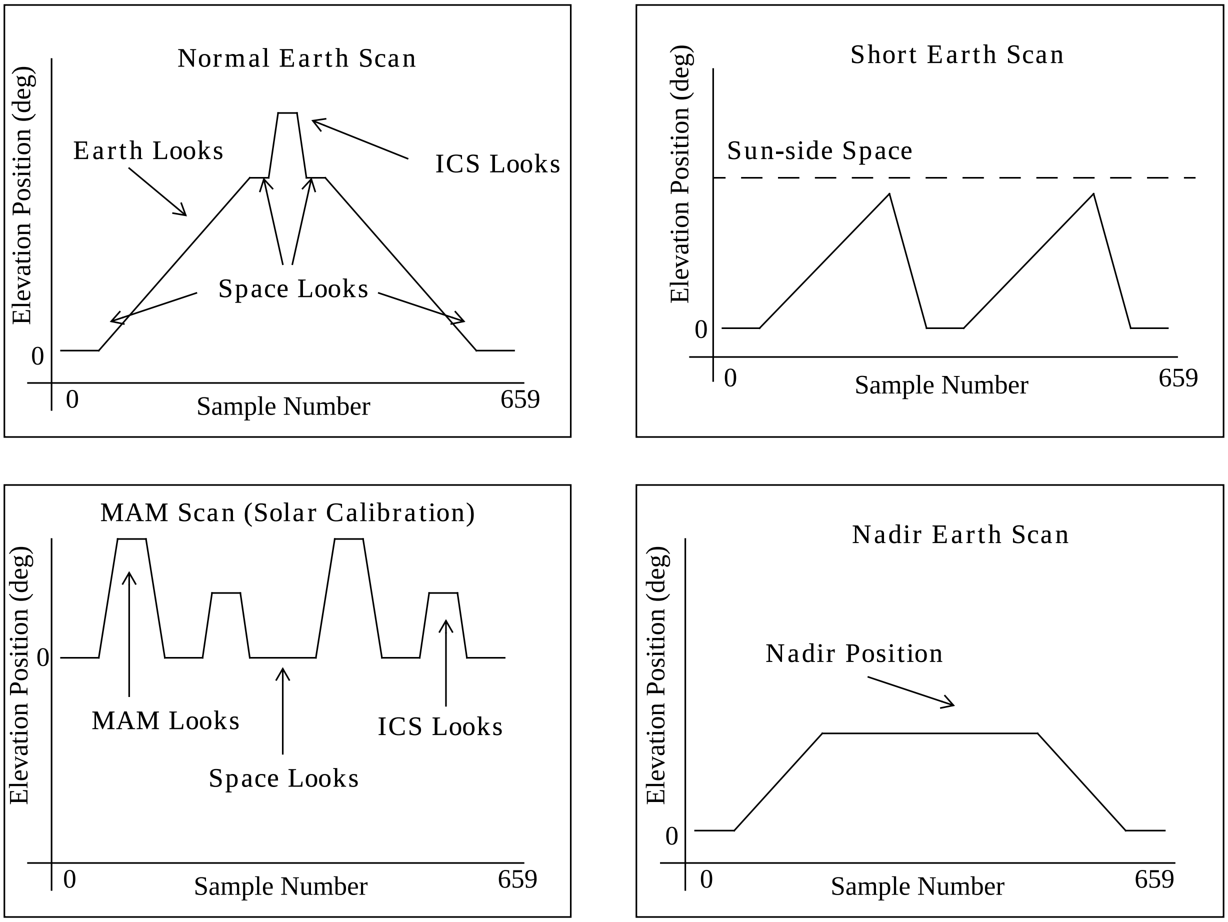

Figure 4-3. CERES Scan Profiles

Table 4-7. Normal Earth Scan Profile

NORMAL EARTH SCAN				
(FOV Look)	TRMM		EOS	
	Sample #	Angle (Deg.)	Sample #	Angle (Deg.)
Space	0	11	0	8
Space	39	11	36	8
Earth	291	169	294	172
Space	311	169	312	172

Table 4-7. Normal Earth Scan Profile

NORMAL EARTH SCAN				
(FOV Look)	TRMM		EOS	
	Sample #	Angle (Deg.)	Sample #	Angle (Deg.)
Housing	320	194	320	194
IntCal	340	194	340	194
Housing	349	169	348	172
Space	369	169	366	172
Earth	621	11	624	8
Space	659	11	659	8

Table 4-8. Short Earth Scan Profile

SHORT EARTH SCAN				
(FOV Look)	TRMM		EOS	
	Sample #	Angle (Deg.)	Sample #	Angle (Deg.)
Space	0	11	0	8
Space	39	11	36	8
Earth	253	145	253	145
Earth	308	11	310	8
Space	352	11	349	8
Earth	566	145	566	145
Earth	621	11	623	8
Space	659	11	659	8

Table 4-9. Nadir Earth Scan Profile

NADIR EARTH SCAN				
(FOV Look)	TRMM		EOS	
	Sample #	Angle (Deg.)	Sample #	Angle (Deg.)
Space	0	11	0	8
Space	39	11	36	8
Earth	165	90	165	90
Earth	495	90	495	90
Earth	621	11	624	8
Space	659	11	659	8

Table 4-10. MAM Scan (Solar Calibration) Profile

MAM SCAN (Solar Calibration)				
(FOV Look)	TRMM		EOS	
	Sample #	Angle (Deg.)	Sample #	Angle (Deg.)
Space	0	169	0	172
Space	52	169	54	172
MAM	79	236	79	236
MAM	130	236	130	236
Space	157	169	155	172
Space	209	169	211	172
Int Cal	218	194	218	194
Int Cal	269	194	269	194
Space	278	169	276	172
Space	382	169	384	172
MAM	409	236	409	236

Table 4-10. MAM Scan (Solar Calibration) Profile

MAM SCAN (Solar Calibration)				
(FOV Look)	TRMM		EOS	
	Sample #	Angle (Deg.)	Sample #	Angle (Deg.)
MAM	460	236	460	236
Space	487	169	485	172
Space	539	169	541	172
Int Cal	548	194	548	194
Int Cal	599	194	599	194
Space	608	169	606	172
Space	659	169	659	172

BDS-17 Radiance and Mode Flags -

This data structure contains the sample level quality flags. The status flag is a 32-bit word where a single bit or slice corresponds to a particular quality assurance or status flag. Every sample contained in the BDS has an associated status flag. The bit ordering of the the status word is shown below in Figure 4-4, the individual flags are defined in Table 4-11, and a description of each flag follows Table 4-11. This flag is also included in the IES, SSF, and CRS products.

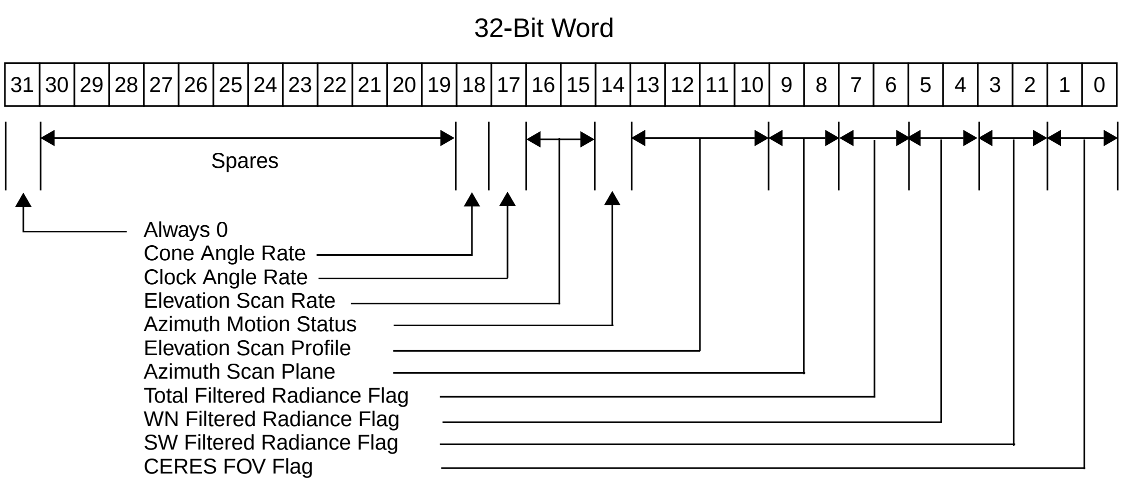

Figure 4-4. Radiance and Mode Flags

Table 4-11. Radiance and Mode Quality Flags Definition

Item	Bits	Flag Parameter Link	Definition
1	0..1	CERES FOV Flag:	00 = Fully Earth Viewing 01 = Hit TOA, Missed Earth 10 = Reserved 11 = Missed TOA and Earth
2	2..3	SW Filtered Radiance Flag:	00 = Good 01 = Suspect 10 = Bad 11 = Reserved
3	4..5	WN Filtered Radiance Flag:	00 = Good 01 = Suspect 10 = Bad 11 = Reserved
4	6..7	Total Filtered Radiance Flag:	00 = Good 01 = Suspect 10 = Bad 11 = Reserved
5	8..9	Azimuth Scan Plane:	00 = Crosstrack 01 = RAPS (Biaxial, Rotating Azimuth Plane) 10 = FAPS (Fixed Azimuth Plane) 11 = Transitional
6	10..13	Elevation Scan Profile:	0000 = Normal Earth Scan 0001 = Short Earth Scan 0010 = MAM Scan 0011 = NADIR Scan 0100 = Stowed Profile 0101 = Other Profile
7	14	Azimuth Motion Status:	0 = Fixed 1 = In Motion
8	15 .. 16	Elevation Scan Rate:	00 = Nominal 01 = Fast 10 = Stopped 11 = Undefined
9	17	Clock Angle Rate:	0 = Good 1 = Bad
10	18	Cone Angle Rate:	0 = Good 1 = Bad
11	19 .. 30	Spares	TBD
12	31	N/A	Always 0

CERES FOV Flag:

A flag set for each CERES measurement sample, it us used to identify where the CERES footprint is viewing. The footprint FOV used by the geolocation calculations is based on the centroid of the image's point-spread-function, not on the mechanical line-of-sight. (Refer to ATBD for PSF discussion.) FOV calculations use the earth surface model (WGS-84) and the CERES TOA model (30km above the WGS-84 model) provided by the ECS Toolkit.

00 = Full Earth-Viewing: This flag for this measurement is set under the following conditions:
- The FOV centroid pierces both the earth surface and the TOA surface, and
- The entire footprint viewing area is determined to be completely on the Earth surface.

01 = Hit TOA, Missed Earth: This flag for this measurement is set under the following conditions:
- The footprint PSF centroid definitely pierces the TOA surface, and
- The footprint PSF centroid may or may not pierce the earth surface (i.e. at the earth's limb), but at least part of the footprint area "touches" the Earth surface (i.e. straddling the Earth limb).

10 = Reserved

11 = Missed TOA and Earth: This flag for this measurement is set under the following conditions:
- The footprint PSF centroid for this measurement did not pierce the TOA surface (e.g. the FOV is looking a cold space above the TOA). Even though the centroid does not pierce the TOA surface, the footprint area could partially overlap this surface.

SW Filtered Radiance Flag:

A flag set for each CERES measurement sample, it is used to indicate the validity of the computed converted filtered radiance measurement. Validity tests are divided into tests of pre-conversion parameters used in the radiance conversion equation and tests of post-conversion edit limits. Pre-conversion validity tests include edit limit checks on the derived spaceclamp values and scan-to-scan spaceclamp change differences (used for offset interpolation). In addition, bridge balance operations for the entire packet are checked before conversions. Post conversion edit checks include instrument housekeeping parameters used in the conversion equation (e.g. heatsink temperature variations) and converted radiance limits.

00 = Good: The radiance for this measurement could be computed. All pre- and post-conversion tests were successful.

01 = Suspect: The radiance for this measurement could be computed. All pre-conversion tests were successful. However, post-conversion edit check test failed. The computed radiance value is still output to the BDS and IES.

10 = Bad: The radiance for this measurement could not be computed due to pre-conversion check test failures. Consequently, the CERES default fill value is output to the BDS and IES instead of the actual computed value.

11 = Reserved

WN Filtered Radiance Flag:

A flag set for each CERES measurement sample, it is used to indicate the validity of the computed converted filtered radiance measurement. Validity tests are divided into tests of pre-conversion parameters used in the radiance conversion equation and tests of post-conversion edit limits. Pre-conversion validity tests include edit limit checks on the derived spaceclamp values and scan-to-scan spaceclamp change differences (used for offset interpolation). In addition, bridge balance operations for the entire packet are checked before conversions. Post conversion edit checks include instrument housekeeping parameters used in the conversion equation (e.g. heatsink temperature variations) and converted radiance limits.

00 = Good: The radiance for this measurement could be computed. All pre- and post-conversion tests were successful.

01 = Suspect: The radiance for this measurement could be computed. All pre-conversion tests were successful. However, post-conversion edit check test failed. The computed radiance value is still output to the BDS and IES.

10 = Bad: The radiance for this measurement could not be computed due to pre-conversion check test failures. Consequently, the CERES default fill value is output to the BDS and IES instead of the actual computed value.

11 = Reserved

Total Filtered Radiance Flag:

A flag set for each CERES measurement sample, it is used to indicate the validity of the computed converted filtered radiance measurement. Validity tests are divided into tests of pre-conversion parameters used in the radiance conversion equation and tests of post-conversion edit limits. Pre-conversion validity tests include edit limit checks on the derived spaceclamp values and scan-to-scan spaceclamp change differences (used for offset interpolation). In addition, bridge balance operations for the entire packet are checked before conversions. Post conversion edit checks include instrument housekeeping parameters used in the conversion equation (e.g. heatsink temperature variations) and converted radiance limits.

00 = Good: The radiance for this measurement could be computed. All pre- and post-conversion tests were successful.

01 = Suspect: The radiance for this measurement could be computed. All pre-conversion tests were successful. However, post-conversion edit check test failed. The computed radiance value is still output to the BDS and IES.

10 = Bad: The radiance for this measurement could not be computed due to pre-conversion check test failures. Consequently, the CERES default fill value is output to the BDS and IES instead of the actual computed value.

11 = Reserved

Azimuth Scan Plane:

A flag derived from scan level information that is copied into each of the 660 measurement QA words, that is used to indicate what the current measurement's azimuth gimbal scan plane. Individual bit patterns are defined as follows:

00 = CrossTrack: This flag is set when the azimuth gimbal is in a verified, fixed, stopped position normal to the spacecraft velocity vector, for the entire scan packet. Typically this means the gimbal is at the 180 degree azimuth position defined by the instrument

coordinate system. This allows the elevation scanner to “sweep” across the ground track in a “side-to-side” motion. This scan plane flag is a special case of the FAPS.

01 = RAPS (Biaxial): This flag is defined as when the azimuth gimbal is in a verified to be rotating between two defined azimuth “end points” for the entire packet.

10 = FAPS: This flag is set when the azimuth gimbal is in a verified, fixed, stopped position at any azimuth position (0..360 degrees) for the entire scan packet. Example conditions are when the instrument is in the “along-track” scan plane where the azimuth position is oriented parallel to the spacecraft velocity vector.

11 = Transitional: Defined as anything not covered above. Typically, this identifies whenever the instrument is changing between the Crosstrack and Biaxial modes while the elevation gimbal in stowed.

Elevation Scan Profile:

A flag derived from scan level information that is copied into each of the 660 measurement QA words. Individual bit patterns are defined as follows:

0000 =Normal-Earth Scan: Verified to be in a Normal-Earth profile for the entire packet.
0001 =Short-Earth Scan: Verified to be in a Short-Earth profile for the entire packet.
0010 =MAM Scan: Verified to be in a MAM scan profile for the entire packet.
0011 = Nadir Scan: Verified to be in a Nadir profile for the entire packet.
0100 = Stowed Profile: Verified to be in the stowed position for the entire packet.
0101 =Anything not classified above.

Azimuth Motion Status:

A flag derived from scan level information that is copied into each of the 660 measurement QA words. Individual bit patterns are defined as follows:

0 = Fixed: Verified to be at actually stopped at a fixed position for the entire packet.

1 = In Motion: This indicates that the azimuth was moving during all or part of the packet. Motions can include performing biaxial scans or transitioning between fixed positions and/or biaxial positions.

Elevation Scan Rate:

A flag set for each CERES measurement sample, this is used to identify the elevation scan rate for the current measurement. This scan rate is computed using the elevation gimbal position (in degrees) from this and the previous measurement and dividing the difference by the measurement-to-measurement duration. This provides an instantaneous rate in degrees per second.

00 = Nominal: The elevation gimbal for this measurement is moving at the nominal 63.14 +/- 2.5 deg./sec.

01 = Fast: The elevation gimbal is moving faster than 63.14 +2.5 deg./sec. for this measurement. Typically this will correspond to when the gimbal is in the “fast retrace” portion of the short-earth scan profile or when slewing to the internal calibration position. (Retrace speed is currently defined as 249.69 +/-10 deg./sec. rate.) However, during scan inflection points (when the gimbal changes motion speed or direction) normal servomechanical “ringing” can occur which could indicate fast rates while the gimbal “settles” out.

10 = Stopped: The elevation gimbal is considered not moving or moving at a slow rate (i.e.

< 63.14 - 2.5 deg/sec) for this measurement. Slow rates are usually identified when the gimbal is ramping up to speed from a stopped position (e.g. from spacelook position).

11 = Undefined: The elevation gimbal scan rate could not be classified into one of the above categories for this measurement. This would be typical of measurements during gimbal transitions between stop and go conditions.)

Clock Angle Rate:

A flag set for each CERES measurement sample, it is used to indicate if a clock angle rate could be computed from valid clock angles and that the rate is within acceptable limits. (See details on clock angle and clock angle rate computations.)

0 = Good: The clock angle rate for this measurement could computed from valid clock angles from this and previous measurement and the rate passed edit check tests.

1 = Bad: The clock angle rate for this measurement could not be computed. Consequently, the CERES default fill value will be output to the BDS and IES clock angle rate field.

Cone Angle Rate:

A flag set for each CERES measurement sample, it is used to indicate if a cone angle rate could be computed from valid cone angles and that the rate is within acceptable limits. (See details on clock angle and clock angle rate computations.)

0 = Good: The cone angle rate for this measurement could computed from valid cone angles from this and previous measurement and the rate passed edit check tests.

1 = Bad: The cone angle rate for this measurement could not be computed. Consequently, the CERES default fill value will be output to the BDS and IES cone angle rate field.

BDS-18 Ancillary QA Flags Set 1 (Radiance Housekeeping):

This word contains detailed information about measurement level data that are used in the radiance conversion algorithm. The bit ordering of the status word is shown below in Figure 4-5.

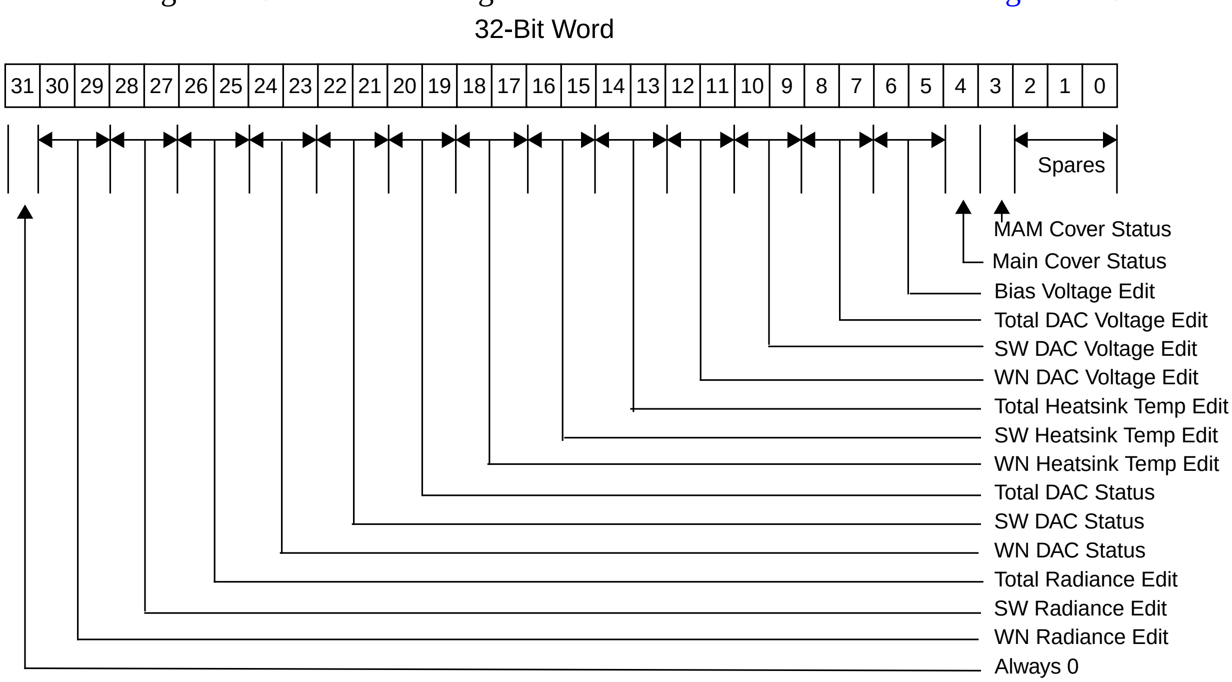

Figure 4-5. Ancillary QA Flags Set 1 (Radiance Housekeeping)

The individual flags are defined in Table 4-12. A combined result of these statuses lead to the setting of the radiance flags in the summary word.

Table 4-12. Ancillary QA Flags Set 1 (Radiance Housekeeping)

Item	Bits	Flag Parameter Link	Definition
1	0..2	Spares (A measurement level flag): Available for future use.	TBD
2	3..3	MAM Cover Status (A scan level flag):	0 = Opened 1 = Closed
3	4..4	Main Cover Status (A scan level flag):	0 = Opened 1 = Closed
4	5..6	Bias Voltage Edit Check (A measurement level flag):	00 = Passed 01 = Failed High Limit 10 = Failed Low Limit 11 = Failed Rate Limit
5	7..8	Total DAC Voltage Edit Check (A measurement level flag):	00 = Passed 01 = Failed High Limit 10 = Failed Low Limit 11 = Failed Rate Limit
6	9..10	SW DAC Voltage Edit Check (A measurement level flag):	00 = Passed 01 = Failed High Limit 10 = Failed Low Limit 11 = Failed Rate Limit
7	11..12	WN DAC Voltage Edit Check (A measurement level flag):	00 = Passed 01 = Failed High Limit 10 = Failed Low Limit 11 = Failed Rate Limit
8	13..14	Total Heatsink Temp. Edit Check (A measurement level flag):	00 = Passed 01 = Failed High Limit 10 = Failed Low Limit 11 = Failed Rate Limit
9	15..16	SW Heatsink Temp. Edit Checks (A measurement level flag):	00 = Passed 01 = Failed High Limit 10 = Failed Low Limit 11 = Failed Rate Limit
10	17..18	WN Heatsink Temp. Edit Check (A measurement level flag):	00 = Passed 01 = Failed High Limit 10 = Failed Low Limit 11 = Failed Rate Limit
11	19..20	Total DAC Status (A scan level flag):	00 = Good 01 = Updated 10 = Reset 11 = Off

Table 4-12. Ancillary QA Flags Set 1 (Radiance Housekeeping)

Item	Bits	Flag Parameter Link	Definition
12	21..22	SW DAC Status (A scan level flag):	00 = Good 01 = Updated 10 = Reset 11 = Off
13	23..24	WN DAC Status (A scan level flag):	00 = Good 01 = Updated 10 = Reset 11 = Off
14	25..26	Total Radiance Edit Check (A measurement level flag):	00 = Passed 01 = Failed High Limit 10 = Failed Low Limit 11 = Failed Rate Limit
15	27..28	SW Radiance Edit Check (A measurement level flag):	00 = Passed 01 = Failed High Limit 10 = Failed Low Limit 11 = Failed Rate Limit
16	29..30	WN Radiance Edit Check (A measurement level flag):	00 = Passed 01 = Failed High Limit 10 = Failed Low Limit 11 = Failed Rate Limit
17	31	3..3	Always 0

Spares (A measurement level flag): Available for future use.

MAM Cover Status (A scan level flag):

0 = Opened: The cover has been determined to be opened.
1 = Closed: The cover has been determined to be closed.

Main Cover Status (A scan level flag):

0 = Opened: The cover has been determined to be opened.
1 = Closed: The cover has been determined to be closed.

Bias Voltage Edit Check (A measurement level flag):

00 = Passed: Converted bias voltage values used to compute a scan average for the radiance count conversion equation passed all edit checks.
01 = Failed High Limit: Converted bias voltage values used to compute a scan average for the radiance count conversion equation failed a high limit edit check.
10 = Failed Low Limit: Converted bias voltage values used to compute a scan average for the radiance count conversion equation failed a low limit edit check.
11 = Failed Rate Limit: Converted bias voltage values used to compute a scan average for the radiance count conversion equation failed a rate (measurement-to-measurement) limit edit check.

Total DAC Voltage Edit Check (A measurement level flag):

00 = Passed: DAC Voltage count values used to compute a scan average for the radiance count conversion equation passed all edit checks.
01 = Failed High Limit: DAC Voltage count values used to compute a scan average for the radiance count conversion equation failed a high limit edit check.
10 = Failed Low Limit: DAC Voltage count values used to compute a scan average for the radiance count conversion equation failed a low limit edit check.
11 = Failed Rate Limit: DAC Voltage count values used to compute a scan average for the radiance count conversion equation failed a rate (measurement-to-measurement) limit edit check.

SW DAC Voltage Edit Check (A measurement level flag):

00 = Passed: DAC Voltage count values used to compute a scan average for the radiance count conversion equation passed all edit checks.
01 = Failed High Limit: DAC Voltage count values used to compute a scan average for the radiance count conversion equation failed a high limit edit check.
10 = Failed Low Limit: DAC Voltage count values used to compute a scan average for the radiance count conversion equation failed a low limit edit check.
11 = Failed Rate Limit: DAC Voltage count values used to compute a scan average for the radiance count conversion equation failed a rate (measurement-to-measurement) limit edit check.

WN DAC Voltage Edit Check (A measurement level flag):

00 = Passed: DAC Voltage count values used to compute a scan average for the radiance count conversion equation passed all edit checks.
01 = Failed High Limit: DAC Voltage count values used to compute a scan average for the radiance count conversion equation failed a high limit edit check.
10 = Failed Low Limit: DAC Voltage count values used to compute a scan average for the radiance count conversion equation failed a low limit edit check.
11 = Failed Rate Limit: DAC Voltage count values used to compute a scan average for the radiance count conversion equation failed a rate (measurement-to-measurement) limit edit check.

Total Heatsink Temp. Edit Check (A measurement level flag):

00 = Passed: Converted heatsink temperature values used to compute a scan average for the radiance count conversion equation passed all edit checks.
01 = Failed High Limit: Converted heatsink temperature values used to compute a scan average for the radiance count conversion equation failed a high limit edit check.
10 = Failed Low Limit: Converted heatsink temperature values used to compute a scan average for the radiance count conversion equation failed a low limit edit check.
11 = Failed Rate Limit: Converted heatsink temperature values used to compute a scan average for the radiance count conversion equation failed a rate (measurement-to-measurement) limit edit check.

SW Heatsink Temp. Edit Checks (A measurement level flag):

00 = Passed: Converted heatsink temperature values used to compute a scan average for the radiance count conversion equation passed all edit checks.

01 = Failed High Limit: Converted heatsink temperature values used to compute a scan average for the radiance count conversion equation failed a high limit edit check.
10 = Failed Low Limit: Converted heatsink temperature values used to compute a scan average for the radiance count conversion equation failed a low limit edit check.
11 = Failed Rate Limit: Converted heatsink temperature values used to compute a scan average for the radiance count conversion equation failed a rate (measurement-to-measurement) limit edit check.

WN Heatsink Temp. Edit Check (A measurement level flag):

00 = Passed: Converted heatsink temperature values used to compute a scan average for the radiance count conversion equation passed all edit checks.
01 = Failed High Limit: Converted heatsink temperature values used to compute a scan average for the radiance count conversion equation failed a high limit edit check.
10 = Failed Low Limit: Converted heatsink temperature values used to compute a scan average for the radiance count conversion equation failed a low limit edit check.
11 = Failed Rate Limit: Converted heatsink temperature values used to compute a scan average for the radiance count conversion equation failed a rate (measurement-to-measurement) limit edit check.

Total DAC Status (A scan level flag):

00 = Good: The bridge balance controller was on and maintaining for this scan.
01 = Updated: The bridge balance controller did an update (fine adjustment) for this scan.
10 = Reset: The bridge balance controller did a reset (coarse adjustment) for this scan.
11 = Off: The bridge balance controller was off for this scan.

SW DAC Status (A scan level flag):

00 = Good: The bridge balance controller was on and maintaining for this scan.
01 = Updated: The bridge balance controller did an update (fine adjustment) for this scan.
10 = Reset: The bridge balance controller did a reset (coarse adjustment) for this scan.
11 = Off: The bridge balance controller was off for this scan.

WN DAC Status (A scan level flag):

00 = Good: The bridge balance controller was on and maintaining for this scan.
01 = Updated: The bridge balance controller did an update (fine adjustment) for this scan.
10 = Reset: The bridge balance controller did a reset (coarse adjustment) for this scan.
11 = Off: The bridge balance controller was off for this scan.

Total Radiance Edit Check (A measurement level flag):

00 = Passed: The radiance value for this measurement passed all edit check tests.
01 = Failed High Limit: The radiance value for this measurement failed the high limit edit check test.
10 = Failed Low Limit: The radiance value for this measurement failed the low limit edit check test.
11 = Failed Rate Limit: The radiance value for this measurement failed a rate (measurement-to-measurement) limit edit check.

SW Radiance Edit Check (A measurement level flag):

00 = Passed: The radiance value for this measurement passed all edit check tests.
01 = Failed High Limit: The radiance value for this measurement failed the high limit edit check test.
10 = Failed Low Limit: The radiance value for this measurement failed the low limit edit check test.
11 = Failed Rate Limit: The radiance value for this measurement failed a rate (measurement-to-measurement) limit edit check.

WN Radiance Edit Check (A measurement level flag):

00 = Passed: The radiance value for this measurement passed all edit check tests.
01 = Failed High Limit: The radiance value for this measurement failed the high limit edit check test.
10 = Failed Low Limit: The radiance value for this measurement failed the low limit edit check test.
11 = Failed Rate Limit: The radiance value for this measurement failed a rate (measurement-to-measurement) limit edit check.

BDS-19 Ancillary QA Flags Set 2 (Instrument Algorithm) Descriptions:

This word contains detailed information about measurement level data that are used in the radiance conversion algorithm. The bit ordering of the the status word is shown below in Figure 4-6.

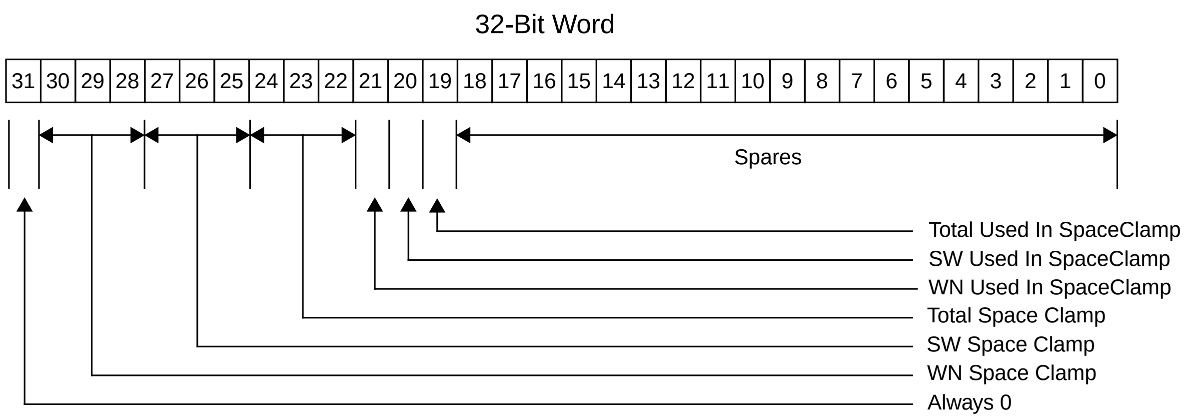

Figure 4-6. Ancillary QA Flags Set 2 (Instrument Algorithm)

The individual instrument algorithm quality flags are defined in Table 4-13. A combined result of these status words lead to the setting of the radiance flags in the summary word.

Table 4-13. Ancillary QA Flags Set 2 (Instrument Algorithm)

Item	Bits	Flag Parameter	Definition
1.	0..20	Spares (A measurement level flag): Available for future use.	TBD

Table 4-13. Ancillary QA Flags Set 2 (Instrument Algorithm)

Item	Bits	Flag Parameter	Definition
2.	23	Total measurement Used In SpaceClamp Algorithm (A measurement level flag):	0 = True 1 = False
3.	22	SW measurement Used In SpaceClamp Algorithm (A measurement level flag):	0 = True 1 = False
4.	21	WN measurement Used In SpaceClamp Algorithm (A measurement level flag):	0 = True 1 = False
5.	22..24	Total SpaceClamp Status (A measurement level flag):	000 = Good 001 = Out of Limit 010 = Not Enough measurements 011 = No Second Value All others = Reserved
6.	25..27	SW SpaceClamp Status (A measurement level flag):	000 = Good 001 = Out of Limit 010 = Not Enough measurements 011 = No Second Value All others = Reserved
7.	28..30	WN SpaceClamp Status (A measurement level flag):	000 = Good 001 = Out of Limit 010 = Not Enough measurements 011 = No Second Value All others = Reserved
8.	31	N/A	Always 0

Spares (A measurement level flag): Available for future use.

Total measurement Used In SpaceClamp Algorithm (A measurement level flag):

0 = True: The detector count value for this measurement was used in making a spaceclamp.
1 = False: The detector count value for this measurement was not used in making a spaceclamp.

SW measurement Used In SpaceClamp Algorithm (A measurement level flag):

0 = True: The detector count value for this measurement was used in making a spaceclamp.
1 = False: The detector count value for this measurement was not used in making a spaceclamp.

WN measurement Used In SpaceClamp Algorithm (A measurement level flag):

0 = True: The detector count value for this measurement was used in making a spaceclamp.
1 = False: The detector count value for this measurement was not used in making a spaceclamp.

Total SpaceClamp Status (A measurement level flag):

000 =Good: The computed spaceclamp used for computing this radiance measurement passed all edit and algorithm tests.
001 =Out of Limit: The computed spaceclamp used for computing this radiance measurement was outside statistical edit limits.
010 =Not Enough measurements: There were an insufficient number of statistically good detector measurements available to compute a quality spaceclamp for this measurement.
011 = No Second Value: A statistically valid spaceclamp from the next scan was not available for radiance computation. The spaceclamp from the current scan was duplicated.
All Others = Reserved for future use.

SW SpaceClamp Status (A measurement level flag):

000 =Good: The computed spaceclamp used for computing this radiance measurement passed all edit and algorithm tests.
001 =Out of Limit: The computed spaceclamp used for computing this radiance measurement was outside statistical edit limits.
010 =Not Enough measurements: There were an insufficient number of statistically good detector measurements available to compute a quality spaceclamp for this measurement.
011 = No Second Value: A statistically valid spaceclamp from the next scan was not available for radiance computation. The spaceclamp from the current scan was duplicated.
All Others = Reserved for future use.

WN SpaceClamp Status (A measurement level flag):

000 =Good: The computed spaceclamp used for computing this radiance measurement passed all edit and algorithm tests.
001 =Out of Limit: The computed spaceclamp used for computing this radiance measurement was outside statistical edit limits.
010 =Not Enough measurements: There were an insufficient number of statistically good detector measurements available to compute a quality spaceclamp for this measurement.
011 = No Second Value: A statistically valid spaceclamp from the next scan was not available for radiance computation. The spaceclamp from the current scan was duplicated.
All Others = Reserved for future use.

BDS-20 Julian Date and Time - This data structure contains the sample julian data and time components. (See Julian time description section.)

BDS-21 Cone Angles

BDS-22 Clock Angles

BDS-23 Cone Angle Rates

BDS-24 Clock Angle Rates

BDS-25 SW Spaceclamp Values

BDS-26 WN Spaceclamp Values

BDS-27 Total Spaceclamp Values

BDS-28 Count Conversion SW Sample Offsets

BDS-29 Count Conversion WN Sample Offsets

BDS-30 Count Conversion Total Sample Offsets

Table 4-14. BDS Diagnostic Gimbal SDS Summary

Link	SDS Name	HDF Rank	Rows	Colu mns	Data Type	Range	Units	Nominal Size (MB)*
BDS-31	Elevation Error Positions	2	n	660	U16 INT	0..65535	count	16.45
BDS-32	Azimuth Error Positions	2	n	660	U16 INT	0..65535	count	16.45
BDS-4	Elevation Positions	2	n	660	U16 INT	0..4095	count	16.45
BDS-5	Azimuth Positions	2	n	660	U16 INT	0..4095	count	16.45
BDS-6	BDS Raw Digital Status Measurement	2	n	185	U16 INT	Table 4-18	N/A	4.62
BDS-33	Converted Elevation Error Angles	2	n	660	32-Bit Float	0.0..360.0	deg	32.96
BDS-34	Converted Azimuth Error Angles	2	n	660	32-Bit Float	0.0..360.0	deg	32.96
BDS-10	Colatitude of CERES FOV at TOA	2	n	660	32-Bit Float	0.0..180.0	deg	32.96
BDS-11	Longitude of CERES FOV at TOA	2	n	660	32-Bit Float	0.0..360.0	deg	32.96
BDS-12	CERES Viewing Zenith at TOA	2	n	660	32-Bit Float	0.0..90.0	deg	32.96
BDS-13	CERES Solar Zenith at TOA	2	n	660	32-Bit Float	0.0..180.0	deg	32.96
BDS-14	CERES Relative Azimuth at TOA	2	n	660	32-Bit Float	0.0..360.0	deg	32.96
BDS-15	Converted Elevation Angles	2	n	660	32-Bit Float	0.0..180.0	deg	32.96
BDS-16	Converted Azimuth Angles	2	n	660	32-Bit Float	0.0..270.0	deg	32.96
BDS-17	Radiance and Mode Flags	2	n	660	U32 Integer	Table 4-11	N/A	32.96
BDS-18	Ancillary QA Flags Set 1	2	n	660	U32 Integer	Table 4-12	N/A	32.96
BDS-19	Ancillary QA Flags Set 2	2	n	660	U32 Integer	Table 4-13	N/A	32.96
BDS-20	Julian Date and Time	2	n	2	64-Bit Float	N/A	day	0.20
	SDS TOTAL SIZE							???.??

Table 4-15. BDS Diagnostic Processor SDS Summary

Link	SDS Name	HDF Rank	Rows	Columns	Data Type	Range	Units	Nominal Size (MB)*
BDS-35	DAP Timing	2	n	660	U16 INT	0..65535	count	16.45
BDS-36	ICP Timing	2	n	660	U16 INT	0..65535	count	16.45
BDS-4	Elevation Positions	2	n	660	U16 INT	0..4095	count	16.45
BDS-5	Azimuth Positions	2	n	660	U16 INT	0..4095	count	16.45
BDS-6	BDS Raw Digital Status Measurement	2	n	185	U16 INT	Table 4-18	N/A	4.62
BDS-37	Converted DAP Timing	2	n	660	32-Bit Float	0.0..10.0	milli-secs	32.96
BDS-38	Converted ICP Timing	2	n	660	32-Bit Float	0.0..10.0	milli-secs	32.96
BDS-10	Colatitude of CERES FOV at TOA	2	n	660	32-Bit Float	0.0..180.0	deg	32.96
BDS-11	Longitude of CERES FOV at TOA	2	n	660	32-Bit Float	0.0..360.0	deg	32.96
BDS-12	CERES Viewing Zenith at TOA	2	n	660	32-Bit Float	0.0..90.0	deg	32.96
BDS-13	CERES Solar Zenith at TOA	2	n	660	32-Bit Float	0.0..180.0	deg	32.96
BDS-14	CERES Relative Azimuth at TOA	2	n	660	32-Bit Float	0.0..360.0	deg	32.96
BDS-15	Converted Elevation Angles	2	n	660	32-Bit Float	0.0..180.0	deg	32.96
BDS-16	Converted Azimuth Angles	2	n	660	32-Bit Float	0.0..270.0	deg	32.96
BDS-17	Radiance and Mode Flags	2	n	660	U32 Integer	Table 4-11	N/A	32.96
BDS-18	Ancillary QA Flags Set 1	2	n	660	U32 Integer	Table 4-12	N/A	32.96
BDS-19	Ancillary QA Flags Set 2	2	n	660	U32 Integer	Table 4-13	N/A	32.96
BDS-20	Julian Date and Time	2	n	2	64-Bit Float	N/A	day	0.20
	SDS TOTAL SIZE							???.??

Table 4-16. BDS Diagnostic Memory SDS Summary

Link	SDS Name	HDF Rank	Rows	Columns	Data Type	Range	Units	Nominal Size (MB)*
BDS-39	Memory Packet Time	2	n	8	U8 INT	0..255	count	0.11
BDS-40	DAP Memory Word	2	n	660	U16 INT	0..65535	count	16.45
BDS-41	ICP Memory Word	2	n	660	U16 INT	0..65535	count	16.45
BDS-4	Elevation Positions	2	n	660	U16 INT	0..4095	count	16.45
BDS-5	Azimuth Positions	2	n	660	U16 INT	0..4095	count	16.45

Link	SDS Name	HDF Rank	Rows	Columns	Data Type	Range	Units	Nominal Size (MB)*
BDS-6	BDS Raw Digital Status Measurement	2	n	185	U16 INT	Table 4-18	N/A	4.62
BDS-10	Colatitude of CERES FOV at TOA	2	n	660	32-Bit Float	0.0..180.0	deg	32.96
BDS-11	Longitude of CERES FOV at TOA	2	n	660	32-Bit Float	0.0..360.0	deg	32.96
BDS-12	CERES Viewing Zenith at TOA	2	n	660	32-Bit Float	0.0..90.0	deg	32.96
BDS-13	CERES Solar Zenith at TOA	2	n	660	32-Bit Float	0.0..180.0	deg	32.96
BDS-14	CERES Relative Azimuth at TOA	2	n	660	32-Bit Float	0.0..360.0	deg	32.96
BDS-15	Converted Elevation Angles	2	n	660	32-Bit Float	0.0..180.0	deg	32.96
BDS-16	Converted Azimuth Angles	2	n	660	32-Bit Float	0.0..270.0	deg	32.96
BDS-17	Radiance and Mode Flags	2	n	660	U32 Integer	Table 4-11	N/A	32.96
BDS-18	Ancillary QA Flags Set 1	2	n	660	U32 Integer	Table 4-12	N/A	32.96
BDS-19	Ancillary QA Flags Set 2	2	n	660	U32 Integer	Table 4-13	N/A	32.96
BDS-20	Julian Date and Time	2	n	2	64-Bit Float	N/A	day	0.20
	SDS TOTAL SIZE							???.??

Table 4-17. BDS Diagnostic Fix

Link	SDS Name	HDF Rank	Rows	Columns	Data Type	Range	Units	Nominal Size (MB)*
BDS-42	Fixed Pattern Word 1	2	n	660	U16 INT	0..65535	count	16.45
BDS-43	Fixed Pattern Word 2	2	n	660	U16 INT	0..65535	count	16.45
BDS-44	Fixed Pattern Word 3	2	n	660	U16 INT	0..4095	count	16.45
BDS-45	Fixed Pattern Word 4	2	n	660	U16 INT	0..4095	count	16.45
BDS-46	Fixed Pattern Word 5	2	n	660	U16 INT	0..4095	count	16.45
BDS-47	Fixed Pattern Word 6	2	n	660	U16 INT	0..4095	count	16.45
BDS-6	BDS Raw Digital Status Measurement	2	n	185	U16 INT	Table 4-18	N/A	4.62
BDS-20	Julian Date and Time	2	n	2	64-Bit Float	N/A	day	0.20
	SDS TOTAL SIZE							???.??

SDS SUMMARY DESCRIPTIONS For the Diagnostic Gimbal, Processor, Memory, and Fixed-Pattern BDSs:

BDS-31 Elevation Error Positions-

This data structure contains the raw elevation gimbal error (commanded versus actual difference) position count values, copied from the input level-0 data files.

BDS-32 Azimuth Error Positions -

This data structure contains the raw azimuth gimbal error (commanded versus actual difference) position count values, copied from the input level-0 data files.

BDS-33 Converted Elevation Error Angles -

This data structure contains the converted elevation gimbal error position degree values.

BDS-34 Converted Azimuth Error Angles -

This data structure contains the converted azimuth gimbal error position degree values.

BDS-35 DAP Timing -

This data structure contains the raw DAP (Data Acquistion microProcessor) execution time count values, copied from the input level-0 data files.

BDS-36 ICP Timing -

This data structure contains the raw ICP (Instrument Control microProcessor) execution time count values, copied from the input level-0 data files.

BDS-37 Converted DAP Timing -

This data structure contains the converted DAP (Data Acquistion microProcessor) execution time millisecond values.

BDS-38 Converted ICP Timing -

This data structure contains the converted ICP (Instrument Control microProcessor) execution time millisecond values.

BDS-39 Memory Packet Time -

This data structure contains the raw telemetry packet secondary header time stamp, copied from the input level-0 data files.

BDS-40 DAP Memory Word -

This data structure contains the raw DAP (Data Acquistion microProcessor) memory word count values, copied from the input level-0 data files.

BDS-41 ICP Memory Word -

This data structure contains the raw ICP (Instrument Control microProcessor) memory word count values, copied from the input level-0 data files.

BDS-42 Fixed Pattern Word 1 -

This data structure contains the raw count value for the 1st word in a fixed pattern record, copied from the input level-0 data files. This word is the substitute for the azimuth parameter.

BDS-43 Fixed Pattern Word 2 -

This data structure contains the raw count value for the 2nd word in a fixed pattern record, copied from the input level-0 data files. This word is the substitute for the elevation parameter.

BDS-44 Fixed Pattern Word 3 -

This data structure contains the raw count value for the 3rd word in a fixed pattern record, copied from the input level-0 data files. This word is the substitute for the Total radiometric parameter.

BDS-45 Fixed Pattern Word 4 -

This data structure contains the raw count value for the 4th word in a fixed pattern record, copied from the input level-0 data files. This word is the substitute for the WN radiometric parameter.

BDS-46 Fixed Pattern Word 5 -

This data structure contains the raw count value for the 5th word in a fixed pattern record, copied from the input level-0 data files. This word is the substitute for the SW radiometric parameter.

BDS-47 Fixed Pattern Word 6 -

This data structure contains the raw count value for the 6th word in a fixed pattern record, copied from the input level-0 data files. This word is the substitute for the analog engineering parameter.

Table 4-18 contains a list of the BDS Raw Digital Status Measurements. The definitions follow the table and are hyperlinked by the entries in the Link column and the DRL-64 Reference column. The Digital Status (DS) Words (also called Instrument Status Data) are primarily data that are internal to the instrument microprocessors. In some cases, data from analog sensors (e.g. heatsink temperatures) that are digitized for microprocessor usage are also included. (Digitization is accomplished using a Digital-to-Analog Converter (DAC).)

Table 4-18. BDS Raw Digital Status Measurement (RDSM)

Link	Word	Parameter Name	Bit Order	Nominal Range or Default *	DRL-64 Reference
DS-1	0	Instrument Mode Sequence Number	0..4	0..10	122
DS-2		Instrument Previous Mode Sequence Number	5..9	0..10	122
DS-3		Mode Sequence Changed By	10..12	0..3	123
DS-4		Mode Sequence Has Changed	13..14	0	
		Spare Bit	15	0	
DS-5	1	Sequence Command Index	0..4	0..31	
DS-6		Sequence Execution Status	5..7	0..3	124
DS-7		Sequence Time to Next Command	8..15	0..255	4N
	2..6	Spare Words	0..15	0	
DS-8	7	Instrument Command Counter	0..15	0..65535	
DS-9	8	Instrument Command Main 1	0..15	0..65535	see Table 4-20
DS-10	9	Instrument Command Parameter 1	0..15	0..65535	see Table 4-20
DS-11	10	Instrument Command Sample Number 1	0..9	0..659	
DS-12		Instrument Command Status 1	10..14	0..14	139
DS-13		Instrument Command Source 1	15	0..1	140
DS-14	11	Instrument Command Main 2	0..15	0..65535	see Table 4-20
DS-15	12	Instrument Command Parameter 2	0..15	0..65535	see Table 4-20

Table 4-18. BDS Raw Digital Status Measurement (RDSM)

Link	Word	Parameter Name	Bit Order	Nominal Range or Default *	DRL-64 Reference
DS-16	13	Instrument Command Sample Number 2	0..9	0..659	
DS-17		Instrument Command Status 2	10..14	0..14	139
DS-18		Instrument Command Source 2	15	0..1	140
DS-19	14	Instrument Command Main 3	0..15	0..65535	see Table 4-20
DS-20	15	Instrument Command Parameter 3	0..15	0..65535	see Table 4-20
DS-21	16	Instrument Command Sample Number 3	0..9	0..659	
DS-22		Instrument Command Status 3	10..14	0..14	139
DS-23		Instrument Command Source 3	15	0..1	140
DS-24	17	Instrument Command Main 4	0..15	0..65535	see Table 4-20
DS-25	18	Instrument Command Parameter 4	0..15	0..65535	see Table 4-20
DS-26	19	Instrument Command Sample Number 4	0..9	0..659	
DS-27		Instrument Command Status 4	10..14	0..14	139
DS-28		Instrument Command Source 4	15	0..1	140
DS-29	20	Instrument Command Main 5	0..15	0..65535	see Table 4-20
DS-30	21	Instrument Command Parameter 5	0..15	0..65535	see Table 4-20
DS-31	22	Instrument Command Sample Number 5	0..9	0..659	
DS-32		Instrument Command Status 5	10..14	0..14	139
DS-33		Instrument Command Source 5	15	0..1	140
DS-34	23	Instrument Command Main 6	0..15	0..65535	see Table 4-20
DS-35	24	Instrument Command Parameter 6	0..15	0..65535	see Table 4-20
DS-36	25	Instrument Command Sample Number 6	0..9	0..659	
DS-37		Instrument Command Status 6	10..14	0..14	139
DS-38		Instrument Command Source 6	15	0..1	140
DS-39	26	Instrument Command Main 7	0..15	0..65535	see Table 4-20
DS-40	27	Instrument Command Parameter 7	0..15	0..65535	see Table 4-20
DS-41	28	Instrument Command Sample Number 7	0..9	0..659	
DS-42		Instrument Command Status 7	10..14	0..14	139
DS-43		Instrument Command Source 7	15	0..1	140
DS-44	29	Instrument Command Main 8	0..15	0..65535	see Table 4-20
DS-45	30	Instrument Command Parameter 8	0..15	0..65535	see Table 4-20
DS-46	31	Instrument Command Sample Number 8	0..9	0..659	
DS-47		Instrument Command Status 8	10..14	0..14	139
DS-48		Instrument Command Source 8	15	0..1	140
DS-49	32	Instrument Error Counter	0..15	0..65535	
DS-50	33	Instrument Error Sample Number 1	0..9	0..659	
DS-51		Instrument Error Type 1	10..15	0..63	141
DS-52	34	Instrument Error Sample Number 2	0..9	0..659	
DS-53		Instrument Error Type 2	10..15	0..63	141
DS-54	35	Instrument Error Sample Number 3	0..9	0..659	
DS-55		Instrument Error Type 3	10..15	0..63	141
DS-56	36	Instrument Error Sample Number 4	0..9	0..659	
DS-57		Instrument Error Type 4	10..15	0..63	141
DS-58	37	Instrument Error Sample Number 5	0..9	0..659	
DS-59		Instrument Error Type 5	10..15	0..63	141

Table 4-18. BDS Raw Digital Status Measurement (RDSM)

Link	Word	Parameter Name	Bit Order	Nominal Range or Default *	DRL-64 Reference
DS-60	38	Instrument Error Sample Number 6	0..9	0..659	
DS-61		Instrument Error Type 6	10..15	0..63	141
DS-62	39	Instrument Error Sample Number 7	0..9	0..659	
DS-63		Instrument Error Type 7	10..15	0..63	141
DS-64	40	Instrument Error Sample Number 8	0..9	0..659	
DS-65		Instrument Error Type 8	10..15	0..63	141
	41..45	Spare Words	0..15	0	
DS-66	46	Total Bridge Balance Control Status	0..2	0..2	101
DS-67		Total Bridge Balance DAC Update Status Value	3	0..1	102
DS-68		Total Bridge Balance Reset Counter	4..8	0..24	
		Spare Bits	9..15	0	
DS-69	47	Total Spacelook Average	0..11	0..4095	
		Spare Bits	12..15	0	
DS-70	48	Total Bridge Balance DAC Coarse Value	0..11	0..4095	
		Spare Bits	12..15	0	
DS-71	49	Total Bridge Balance DAC Fine Value	0..11	0..4095	
		Spare Bits	12..15	0	
DS-72	50	SW Bridge Balance Control Status	0..2	0..2	101
DS-73		SW Bridge Balance DAC Update Status Value	3	0..1	102
DS-74		SW Bridge Balance Reset Counter	4..8	0..24	
		Spare Bits	9..15	0	
DS-75	51	SW Spacelook Average	0..11	0..4095	
		Spare Bits	12..15	0	
DS-76	52	SW Bridge Balance DAC Coarse Value	0..11	0..4095	
		Spare Bits	12..15	0	
DS-77	53	SW Bridge Balance DAC Fine Value	0..11	0..4095	
		Spare Bits	12..15	0	
DS-78	54	WN Bridge Balance Control Status	0..2	0..2	101
DS-79		WN Bridge DAC Update Status Value	3	0..1	102
DS-80		WN Bridge Balance Reset Counter	4..8	0..24	
		Spare Bits	9..15	0	
DS-81	55	WN Spacelook Average	0..11	0..4095	
		Spare Bits	12..15	0	
DS-82	56	WN Bridge Balance DAC Coarse Value	0..11	0..4095	
		Spare Bits	12..15	0	
DS-83	57	WN Bridge Balance DAC Fine Value	0..11	0..4095	
		Spare Bits	12..15	0	
DS-84	58	Bridge Balance Spacelook Start Sample Number	0..9	5	
		Spare Bits	10..15	0	
DS-85	59	Bridge Balance Spacelook End Sample Number	0..9	25	
		Spare Bits	10..15	0	
DS-86	60	Bridge Balance DAC Update Sample Number	0..9	644	
		Spare Bits	10..15	0	

Table 4-18. BDS Raw Digital Status Measurement (RDSM)

Link	Word	Parameter Name	Bit Order	Nominal Range or Default *	DRL-64 Reference
DS-87	61	Bridge Balance Window High Value	0..11	300	
		Spare Bits	12..15	0	
DS-88	62	Bridge Balance Window Low Value	0..11	50	
		Spare Bits	12..15	0	
DS-89	63	Bridge Balance Window Setpoint Value	0..11	225	
		Spare Bits	12..15	0	
DS-90	64	Total Detector Temperature Setpoint	0..11	0..4095	
DS-91		Total Detector Temperature Control Status	12	0..1	100
		Spare Bits	13..15	0	
DS-92	65	SW Detector Temperature Setpoint	0..11	0..4095	
DS-93		SW Detector Temperature Control Status	12	0..1	100
		Spare Bits	13..15	0	
DS-94	66	WN Detector Temperature Setpoint	0..11	0..4095	
DS-95		WN Detector Temperature Control Status	12	0..1	100
		Spare Bits	13..15	0	
DS-96	67	Blackbody Temperature Setpoint	0..11	0..4095	
DS-97		Blackbody Temperature Control Status	12	0..1	100
		Spare Bits	13..15	0	
DS-98	68	SWICS Intensity Level	0..1	0..3	103
		Spare Bits	2..15	0	
	69	Spare Word	0..15	0	
DS-99	70	Elevation Scan Mode	0..4	0..4	108
DS-100		Elevation On Deck Scan Mode	5..9	0..4	108
DS-101		Elevation Scan Status	10..12	0..4	109
DS-102		Elevation Motor Drive	13	0..1	115
DS-103		Elevation Encoder LED Intensity	14	0..1	110
DS-104		Elevation Stall	15	0..1	136
DS-105	71	Elevation Offset Correction	0..15	65082	4K
DS-106	72	Elevation Stall Error Threshold	0..15	32767	
DS-107	73	Elevation Stall Count Threshold	0..9	660	
		Spare Bits	10..15	0	
DS-108	74	Elevation Position Error Sample 1	0..15	0..65535	
DS-109	75	Elevation Position Error Sample 2	0..15	0..65535	
DS-110	76	Elevation Position Error Sample 3	0..15	0..65535	
DS-111	77	Main Cover Command	0..3	0..5	104
DS-112		Main Cover Motion Status	4..7	0..15	105
DS-113		Main Cover Position Status	8..11	0..4	106
DS-114		Main Cover Sensor Active	12..13	0..1	107
		Spare Bits	14..15	0	
DS-115	78	Main Cover Commanded Position	0..11	0..4095	
		Spare Bits	12..15	0	
DS-116	79	Main Cover Accumulated Lag Error Sensor 1	0..7	0..255	
		Spare Bits	8..15	0	

Table 4-18. BDS Raw Digital Status Measurement (RDSM)

Link	Word	Parameter Name	Bit Order	Nominal Range or Default *	DRL-64 Reference
DS-117	80	Main Cover Accumulated Lag Error Sensor 2	0..7	0..255	
		Spare Bits	8..15	0	
DS-118	81	Main Cover Fixed Step Count	0..15	0..65535	
DS-119	82	Main Cover Defined Closed Position	0..11	241	
		Spare Bits	12..15	0	
DS-120	83	Main Cover Defined Open Position	0..11	3164	
		Spare Bits	12..15	0	
DS-121	84	Main Cover Defined Closed Margin	0..11	30	
		Spare Bits	12..15	0	
DS-122	85	Main Cover Defined Open Margin	0..11	30	
		Spare Bits	12..15	0	
DS-123	86	MAM Cover Command	0..3	0..5	104
DS-124		MAM Cover Motion Status	4..7	0..15	105
DS-125		MAM Cover Position Status	8..11	0..4	106
DS-126		MAM Cover Sensor Active	12..13	0..1	107
		Spare Bits	14..15	0	
DS-127	87	MAM Cover Commanded Position	0..11	0..4095	
		Spare Bits	12..15	0	
	88.. 89	Spare Words	0..15	0	
DS-128	90	MAM Cover Fixed Step Count	0..15	0..65535	
DS-129	91	MAM Cover Defined Closed Position	0..11	801	
		Spare Bits	12..15	0	
DS-130	92	MAM Cover Defined Open Position	0..11	1924	
		Spare Bits	12..15	0	
DS-131	93	MAM Cover Defined Closed Margin	0..11	20	
		Spare Bits	12..15	0	
DS-132	94	MAM Cover Defined Open Margin	0..11	20	
		Spare Bits	12..15	0	
DS-133	95	DAP Watchdog Boot Status	0	0..1	127
DS-134		DAP Watchdog Enable Status	1	0..1	128
DS-135		DAP PROM Power Status	2	0..1	129
DS-136		DAP Sample Clock Interrupt Occurred	3..4	0	
		Spare Bits	5..15	0	
DS-137	96	DAP Processor Scan Period Count	0..15	0..65535	
DS-138	97	DAP Memory Dump Start Address Offset	0..15	0..65535	
DS-139	98	DAP Memory Dump Start Address Segment	0..15	0..65535	
DS-140	99	DAP Memory Dump End Address Offset	0..15	0..65535	
DS-141	100	DAP Memory Dump End Address Segment	0..15	0..65535	
DS-142	101	DAP Packet Start Address Offset	0..15	0..65535	
DS-143	102	DAP Packet Start Address Segment	0..15	0..65535	
DS-144	103	DAP Address Changes Indicator	0..15	0	
DS-145	104	DAP Minimum Execution Time	0..15	0..65535	4N

Table 4-18. BDS Raw Digital Status Measurement (RDSM)

Link	Word	Parameter Name	Bit Order	Nominal Range or Default *	DRL-64 Reference
DS-146	105	DAP Minimum Sample Number	0..10	0..659	
		Spare Bits	11..15	0	
DS-147	106	DAP Maximum Execution Time	0..15	0..65535	4N
DS-148	107	DAP Maximum Sample Number	0..10	0..659	
		Spare Bits	11..15	0	
DS-149	108	DAP RAM Code Checksum	0..15	0..65535	
DS-150	109	DAP ROM Code Checksum	0..15	0..65535	
	110.. 114	Spare Words	0..15	0	
DS-151	115	Azimuth Mode	0..4	0..10	111
DS-152		Azimuth Motion Status	5	0..1	112
DS-153		Azimuth Direction Status	6	0..1	113
DS-154		Azimuth Position Status	7..10	0..4	114
DS-155		Azimuth Motor Drive Status	11	0..1	115
DS-156		Azimuth Encoder LED Status	12	0..1	110
DS-157		Azimuth Stall	13	0..1	136
		Spare Bits	14..15	0	
DS-158	116	Azimuth Defined Crosstrack Position	0..15	32773	4K
DS-159	117	Azimuth Defined Fixed Position A - Normal Azimuth Defined Fixed Position A - (Short)	0..15	16389 (20024)	4K
DS-160	118	Azimuth Defined Fixed Position B - Normal Azimuth Defined Fixed Position B - (Short)	0..15	49157 (45510)	4K
DS-161	119	Azimuth Defined Fixed Solar Calibration Position	0..15	0..65535	4K
DS-162	120	Azimuth Defined Fixed Cage Position	0..15	21	4K
DS-163	121	Azimuth Defined Fixed Position Spare 1	0..15	8197	4K
DS-164	122	Azimuth Defined Fixed Position Spare 2	0..15	30000	4K
DS-165	123	Azimuth Defined Fixed Position Spare 3	0..15	60000	4K
DS-166	124	Azimuth Defined Normal Slew Rate	0..15	1371	7.
DS-167	125	Azimuth Defined Asynchronous Scan Rate	0..15	1096	7.
DS-168	126	Azimuth Defined Synchronous Scan Rate	0..15	913	7.
DS-169	127	Azimuth Offset Correction	0..15	65394	4K
DS-170	128	Azimuth Stall Error Threshold	0..15	500	
DS-171	129	Azimuth Stall Count Threshold	0..9	10	
		Spare Bits	10..15	0	
DS-172	130	Brake Command Status	0..3	0..5	116
DS-173		Brake Motion Status	4..7	0..15	117
DS-174		Brake Position Status	8..11	0..4	118
		Spare Bits	12..15	0	
DS-175	131	Brake Commanded Position	0..11	0..4095	
		Spare Bits	12..15	0	
DS-176	132	Brake Current Position	0..11	0..4095	
		Spare Bits	12..15	0	
DS-177	133	Brake Position SUBMUX Channel	0..7	163	
		Spare Bits	8..15	0	
DS-178	134	Brake Step Count	0..15	0..65535	

Table 4-18. BDS Raw Digital Status Measurement (RDSM)

Link	Word	Parameter Name	Bit Order	Nominal Range or Default *	DRL-64 Reference
DS-179	135	Brake Defined Released Position	0..11	800	
		Spare Bits	12..15	0	
DS-180	136	Brake Defined Applied Position	0..11	685	
		Spare Bits	12..15	0	
DS-181	137	Brake Defined Cage Position	0..11	1027	
		Spare Bits	12..15	0	
DS-182	138	Brake Defined Released Margin	0..11	50	
		Spare Bits	12..15	0	
DS-183	139	Brake Defined Applied Margin	0..11	5	
		Spare Bits	12..15	0	
DS-184	140	Brake Defined Cage Margin	0..11	5	
		Spare Bits	12..15	0	
DS-185	141	Azimuth Position Error Value	0..15	0..65535	
DS-186	142 (TRMM WORD)	Safehold Input A Status	0	0..1	125
DS-187		Safehold Input B Status	1	0..1	125
DS-188		Safehold Response A Status	2..3	0..3	126
DS-189		Safehold Response B Status	4..5	0..3	126
		Spare Bits	6..15	0	
DS-190	142 (EOS-AM WORD)	Low Rate Science Transfer Status	0	0..1	143
DS-191		Safemode Signal Received	1	0..1	144
DS-192		Safemode Signal Response	2	0..1	143
DS-193		IMOK Signal Received	3	0..1	145
DS-194		IMOK Signal Response	4	0..1	143
DS-195		Time Mark & Frequency Bus Select	5	0..1	146
DS-196		Time Mark & Frequency Interrupt	6	0..1	147
		Spare Bits	7..15	0	
DS-197	143	ICP Watchdog Boot Status	0	0..1	127
DS-198		ICP Watchdog Enable Status	1	0..1	128
DS-199		ICP PROM Power Status	2	0..1	129
DS-200		ICP Sample Clock Interrupt Occurred	3..4	0	
DS-201		DMA Communication Status	5..7	0..3	138
		Spare Bits	8..15	0	
DS-202	144	ICP Scan Period Counter	0..15	0..65535	
DS-203	145	ICP Memory Dump Start Address Offset	0..15	0..65535	
DS-204	146	ICP Memory Dump Start Address Segment	0..15	0..65535	
DS-205	147	ICP Memory Dump End Address Offset	0..15	0..65535	
DS-206	148	ICP Memory Dump End Address Segment	0..15	0..65535	
DS-207	149	ICP Packet Start Address Offset	0..15	0..65535	
DS-208	150	ICP Packet Start Address Segment	0..15	0..65535	
DS-209	151	ICP Address Changed Indicator	0..15	0	
DS-210	152	ICP Minimum Execution Time	0..15	0..65535	4N
DS-211	153	ICP Minimum Sample Number	0..10	0..659	
		Spare Bits	11..15	0	
DS-212	154	ICP Maximum Execution Time	0..15	0..65535	4N

Table 4-18. BDS Raw Digital Status Measurement (RDSM)

Link	Word	Parameter Name	Bit Order	Nominal Range or Default *	DRL-64 Reference
DS-213	155	ICP Maximum Sample Number	0..10	0..659	
		Spare Bits	11..15	0	
DS-214	156	ICP RAM Code Checksum	0..15	0..65535	
DS-215	157	ICP ROM Code Checksum	0..15	0..65535	
	158.. 162	Spare Words	0..15	0	
DS-216	163	SPS 1 State	0	0..1	130
DS-217		SPS 2 State	1	0..1	130
DS-218		SPS 1 Response	2	0..1	131
DS-219		SPS 2 Response	3	0..1	131
DS-220		Solar Warning	4..5	0..1	133
DS-221		Scan Timeout Response	6	0..1	134
DS-222		Scan Timeout Counting	7..8	0..1	135
DS-223		Scan Timeout Occurred	9..10	0..1	142
		Spare Bits	11..15	0	
DS-224	164	Solar Warning Event Sample Number	0..15	0..659	
DS-225	165	Solar Warning Event Scan Period	0..15	0..65535	
DS-226	166	Scan Timeout Scan Period	0..15	0..65535	
DS-227	167	SPS 1 Narrow FOV Signal	0..11	0..4095	
		Spare Bits	12..15	0	
DS-228	168	SPS 1 Wide FOV Signal	0..11	0..4095	
		Spare Bits	12..15	0	
DS-229	169	SPS 1 Threshold Noise	0..11	500	
		Spare Bits	12..15	0	
DS-230	170	SPS 1 Threshold Scale Numerator	0..5	32	
		Spare Bits	6..15	0	
DS-231	171	SPS 1 Solar Detection State	0	0..1	132
		Spare Bits	1..15	0	
DS-232	172	SPS 1 Solar Detection Count	0..9	0..55	
		Spare Bits	10..15	0	
DS-233	173	SPS 1 Solar Detection Count Threshold	0..9	5	
		Spare Bits	10..15	0	
DS-234	174	SPS 1 Solar Detection Max Count	0..9	0..55	
		Spare Bits	10..15	0	
DS-235	175	SPS 2 Narrow FOV Signal	0..11	0..4095	
		Spare Bits	12..15	0	
DS-236	176	SPS 2 Wide FOV Signal	0..11	0..4095	
		Spare Bits	12..15	0	
DS-237	177	SPS 2 Threshold Noise	0..11	500	
		Spare Bits	12..15	0	
DS-238	178	SPS 2 Threshold Scale Numerator	0..5	32	
		Spare Bits	6..15	0	
DS-239	179	SPS 2 Solar Detection State	0	0..1	132
		Spare Bits	1..15	0	

Table 4-18. BDS Raw Digital Status Measurement (RDSM)

Link	Word	Parameter Name	Bit Order	Nominal Range or Default *	DRL-64 Reference
DS-240	180	SPS 2 Solar Detection Count	0..9	0..55	
		Spare Bits	10..15	0	
DS-241	181	SPS 2 Solar Detection Count Threshold	0..9	5	
		Spare Bits	10..15	0	
DS-242	182	SPS 2 Solar Detection Max Count	0..9	0..55	
		Spare Bits	10..15	0	
DS-243	183	Solar Avoidance Initial Scan Count	0..9	0..1000	
		Spare Bits	10..15	0	
DS-244	184	Solar Avoidance Current Scan Count	0..9	0..1000	
		Spare Bits	10..15	0	

* Note: Values in this column typically represents flight condition expected ranges, nominal single values, or enumerated values. Ranges specified will not necessarily use the total number of bits available for a given parameter, but will not exceed the maximum number available.

DATA DESCRIPTIONS:

DS-1 Instrument Mode Sequence Number -

This parameter indicates the current internal mode sequence that is either being executed or has completed execution. The enumeration of this value is in Table 4-19, note 122. The detailed sequences for each mode are found in Reference 9 (DRL-87). This parameter will reflect the SET_INSTRUMENT_MODE command. Note: This parameter will not reflect short commands that effectively places the instrument into another “mode configuration”.

DS-2 Instrument Previous Mode Sequence Number -

This parameter indicates the internal mode sequence that was previously executed. The enumeration of this value is in Table 4-19, note 122. The detailed sequences for each mode is found in Reference 9 (DRL-87).

DS-3 Mode Sequence Changed By -

This parameter indicates whether the current internal mode sequence was initiated by a spacecraft or internal instrument command or a safing operation (spacecraft safehold or solar avoidances). See Table 4-19, note 123

DS-4 Mode Sequence Has Changed -

This parameter is for internal flight code usage and was for instrument ground testing only. This value should always = 0.

DS-5 Sequence Command Index -

This parameter is a counter that points to the current short command being executed within an internal mode sequence. This value will hold on the last sequence command upon sequence completion. The index range is nominally 0..29.

DS-6 Sequence Execution Status -

This parameter indicates the current state of an internal mode sequence execution within a packet. This status is required since most sequences typically execute over multiple packets and are often synchronized to the azimuth gimbal motions (e.g. Waiting_For_Azimuth motion to complete) and packet boundaries (e.g. Waiting_For_Next_Scan). The enumeration of this value is in Table 4-19, note 124. Azimuth gimbal considerations are required to avoid potential on-orbit solar viewing geometry conditions.

DS-7 Sequence Time to Next Command -
This parameter indicates the time remaining before the next command is to be executed in a currently executing mode sequence. This can provide the user with scheduling information so that external short commands won't overlap sequences in the middle of execution; unless it is another mode sequence command. The converted value is computed using DRL-64 (Reference 8) algorithm 4 Linear Coefficients listed in Table 8-3 Sub-type M.

DS-8 Instrument Command Counter -
This parameter is a 16 bit counter that reflects the latest instrument command received on the command echo stack, regardless of its executability or source. However, if the instrument is unable to receive the command (e.g. via the spacecraft interface bus), then this counter will not be updated. The command will also not be placed on the stack.

On-board command stack parameters

The next forty (40) parameters are associated with the on-board command stack that holds up to eight (8) commands each containing the following information: Command_Main, Command_Parameter, Command_Sample_Number, Command_Status, and Command_Source. The detailed breakdown of the Command_Main and Command_Parameter is shown in Table 4-20. The Command_Sample_Number indicates the sample number within the packet the command was executed. The Command_Status indicates the results of a given command's execution indicated in Table 4-19, note 139. The Command_Source identifies the originator of the command indicated in Table 4-19, note 140.

DS-9 Instrument Command Main 1

DS-10 Instrument Command Parameter 1

DS-11 Instrument Command Sample Number 1

DS-12 Instrument Command Status 1

DS-13 Instrument Command Source 1

DS-14 Instrument Command Main 2

DS-15 Instrument Command Parameter 2

DS-16 Instrument Command Sample Number 2

DS-17 Instrument Command Status 2

DS-18 Instrument Command Source 2

DS-19 Instrument Command Main 3

DS-20 Instrument Command Parameter 3

DS-21 Instrument Command Sample Number 3

DS-22 Instrument Command Status 3

DS-23 Instrument Command Source 3

DS-24 Instrument Command Main 4

DS-25 Instrument Command Parameter 4

DS-26 Instrument Command Sample Number 4

DS-27 Instrument Command Status 4

DS-28 Instrument Command Source 4

DS-29 Instrument Command Main 5

DS-30 Instrument Command Parameter 5

DS-31 Instrument Command Sample Number 5

DS-32 Instrument Command Status 5

DS-33 Instrument Command Source 5

DS-34 Instrument Command Main 6

DS-35 Instrument Command Parameter 6

DS-36 Instrument Command Sample Number 6

DS-37 Instrument Command Status 6

DS-38 Instrument Command Source 6

DS-39 Instrument Command Main 7

DS-40 Instrument Command Parameter 7

DS-41 Instrument Command Sample Number 7

DS-42 Instrument Command Status 7

DS-43 Instrument Command Source 7

DS-44 Instrument Command Main 8

DS-45 Instrument Command Parameter 8

DS-46 Instrument Command Sample Number 8

DS-47 Instrument Command Status 8

DS-48 Instrument Command Source 8

DS-49 Instrument Error Counter -
This parameter is a 16 bit counter that reflects the latest microprocessor error(s) that occurred within a packet.

On-board microprocessor error stack parameters

The next sixteen (16) parameters are associated with the on-board microprocessor error stack that holds up to eight (8) error conditions each containing the following information: a Error_Type and a Error_Sample_Number. This stack reflects any flight code execution problems that may occur during instrument operation. This stack is independent of the command stack, even though there appears to be similarities. The Error_Type values are found in Table 4-19, note 141. The Error_Sample_Number indicates the sample number within the packet when the microprocessor error occurred.

DS-50 Instrument Error Sample Number 1

DS-51 Instrument Error Type 1

DS-52 Instrument Error Sample Number 2

DS-53 Instrument Error Type 2

DS-54 Instrument Error Sample Number 3

DS-55 Instrument Error Type 3

DS-56 Instrument Error Sample Number 4

DS-57 Instrument Error Type 4

DS-58 Instrument Error Sample Number 5

DS-59 Instrument Error Type 5

DS-60 Instrument Error Sample Number 6

DS-61 Instrument Error Type 6

DS-62 Instrument Error Sample Number 7

DS-63 Instrument Error Type 7

DS-64 Instrument Error Sample Number 8

DS-65 Instrument Error Type 8

DS-66 Total Bridge Balance Control Status -
This parameter indicates if the bridge balance circuitry is off, resetting, or maintaining. See Table 4-19, note 101. During resets, coarse adjustments are being performed. During maintaining, the fine adjustments are made only when the internal spacelook average is between the Bridge Balance Window High Value and Low Values. (See section on Bridge Balances (TBD) for further details.) This parameter reflects the SET_TOTAL_BRIDGE_BAL_CONTROL_MODE command.

DS-67 Total Bridge Balance DAC Update Status Value -
This parameter indicates if the bridge balance circuitry performed a fine adjustment update for the current packet. See Table 4-19, note 102. Any updating will begin on the sample defined by the Bridge Balance DAC Update Sample Number parameter.

NOTE: If any of the three detector channels determine an update is needed, then the updating procedure is activated for all channels. However, only the selected channel will actually act on the revised DAC value and this DAC update status parameter will change.

DS-68 Total Bridge Balance Reset Counter -
This parameter indicates the number of scan counts the instrument is using to balance the bridge in a reset condition. The initial count is set by a successive approximation algorithm that estimates the number of scans to bring the bridge back into balance. The initial default value = 24. During resetting operations, this counter is decremented until it reaches zero. If the bridge is still not balanced, the procedure is repeated, otherwise the instrument will continue in a maintenance state. (See section on Bridge Balances (TBD) for further details.

DS-69 Total Spacelook Average -
This parameter is an integer average of raw total channel radiance counts for the number of samples bounded by the Bridge Balance Spacelook Start Sample Number and Bridge Balance Spacelook End Sample Number. This value is then used to determine if a balance DAC update (or reset) is required.

DS-70 Total Bridge Balance DAC Coarse Value -
This parameter indicates the current digital value (raw counts) used to control the bridge balance circuitry that was last commanded to the instrument or rederived every packet. This digital value is converted to an analog voltage using a Digital to Analog Converter (DAC). Under nominal conditions, this value should be around the middle of a 12 bit range. This value can be commanded to a set value using the SET_TOT_BRID_BAL_COARSE_DAC_VALUE, though it is not expected to be used under nominal conditions.

DS-71 Total Bridge Balance DAC Fine Value -
This parameter indicates the current digital value (raw counts) used to control the bridge balance circuitry that was last commanded to the instrument or rederived every packet. This digital value is converted to an analog voltage using a Digital to Analog Converter (DAC). Under nominal conditions, this value should be around the middle of a 12 bit range. This value can be commanded to a set value using the SET_TOT_BRID_BAL_COARSE_DAC_VALUE, though it is not expected to be used under nominal conditions.

DS-72 SW Bridge Balance Control Status -
This parameter indicates if the bridge balance circuitry is off, resetting, or maintaining. See Table 4-19, note 101. During resets, coarse adjustments are being performed. During maintaining, the fine adjustments are made only when the internal spacelook average is between the Bridge Balance Window High Value and Low Values. (See section on Bridge Balances (TBD) for further details.) This parameter reflects the SET_SW_BRIDGE_BAL_CONTROL_MODE command.

DS-73 SW Bridge Balance DAC Update Status Value -
This parameter indicates if the bridge balance circuitry performed a fine adjustment update for the current packet. See Table 4-19, note 102. Any updating will begin on the sample defined by the Bridge Balance DAC Update Sample Number parameter.

NOTE: If any of the three detector channels determine an update is needed, then the updating procedure is activated for all channels. However, only the selected channel will actually act on the revised DAC value and this DAC update status parameter will change.

DS-74 SW Bridge Balance Reset Counter -
This parameter indicates the number of scan counts the instrument is using to balance the bridge in a reset condition. The initial count is set by a successive approximation algorithm that estimates

the number of scans to bring the bridge back into balance. The initial default value = 24. During resetting operations, this counter is decremented until it reaches zero. If the bridge is still not balanced, the procedure is repeated, otherwise the instrument will continue in a maintenance state. (See section on Bridge Balances (TBD) for further details.

DS-75 SW Spacelook Average -
This parameter is an integer average of raw shortwave channel radiance counts for the number of samples bounded by the Bridge Balance Spacelook Start Sample Number and Bridge Balance Spacelook End Sample Number. This value is then used to determine if a balance DAC update (or reset) is required.

DS-76 SW Bridge Balance DAC Coarse Value -
This parameter indicates the current digital value (raw counts) used to control the bridge balance circuitry that was last commanded to the instrument or rederived every packet. This digital value is converted to an analog voltage using a Digital to Analog Converter (DAC). Under nominal conditions, this value should be around the middle of a 12 bit range. This value can be commanded to a set value using the SET_SW_BRID_BAL_COARSE_DAC_VALUE, though it is not expected to be used under nominal conditions.

DS-77 SW Bridge Balance DAC Fine Value -
This parameter indicates the current digital value (raw counts) used to control the bridge balance circuitry that was last commanded to the instrument or rederived every packet. This digital value is converted to an analog voltage using a Digital to Analog Converter (DAC). Under nominal conditions, this value should be around the middle of a 12 bit range. This value can be commanded to a set value using the SET_SW_BRID_BAL_FINE_DAC_VALUE, though it is not expected to be used under nominal conditions.

DS-78 WN Bridge Balance Control Status -
This parameter indicates if the bridge balance circuitry is off, resetting, or maintaining. Table 4-19, note 101. During resets, coarse adjustments are being performed. During maintaining, the fine adjustments are made only when the internal spacelook average is between the Bridge Balance Window High Value and Low Values. (See section on Bridge Balances (TBD) for further details.) This parameter reflects the SET_WN_BRIDGE_BAL_CONTROL_MODE command.

DS-79 WN Bridge DAC Update Status Value -
This parameter indicates if the bridge balance circuitry performed a fine adjustment update for the current packet. See Table 4-19, note 102. Any updating will begin on the sample defined by the Bridge Balance DAC Update Sample Number parameter.

NOTE: If any of the three detector channels determine an update is needed, then the updating procedure is activated for all channels. However, only the selected channel will actually act on the revised DAC value and this DAC update status parameter will change.

DS-80 WN Bridge Balance Reset Counter -
This parameter indicates the number of scan counts the instrument is using to balance the bridge in a reset condition. The initial count is set by a successive approximation algorithm that estimates the number of scans to bring the bridge back into balance. The initial default value = 24. During resetting operations, this counter is decremented until it reaches zero. If the bridge is still not balanced, the procedure is repeated, otherwise the instrument will continue in a maintenance state.

(See section on Bridge Balances (TBD) for further details.

DS-81 WN Spacelook Average -
This parameter is an integer average of raw longwave channel radiance counts for the number of samples bounded by the Bridge Balance Spacelook Start Sample Number and Bridge Balance Spacelook End Sample Number. This value is then used to determine if a balance DAC update (or reset) is required.

DS-82 WN Bridge Balance DAC Coarse Value -
This parameter indicates the current digital value (raw counts) used to control the bridge balance circuitry that was last commanded to the instrument or rederived every packet. This digital value is converted to an analog voltage using a Digital to Analog Converter (DAC). Under nominal conditions, this value should be around the middle of a 12 bit range. This value can be commanded to a set value using the SET_WN_BRID_BAL_COARSE_DAC_VALUE, though it is not expected to be used under nominal conditions.

DS-83 WN Bridge Balance DAC Fine Value -
This parameter indicates the current digital value (raw counts) used to control the bridge balance circuitry that was last commanded to the instrument or rederived every packet. This digital value is converted to an analog voltage using a Digital to Analog Converter (DAC). Under nominal conditions, this value should be around the middle of a 12 bit range. This value can be commanded to a set value using the SET_WN_BRID_BAL_FINE_DAC_VALUE, though it is not expected to be used under nominal conditions.

DS-84 Bridge Balance Spacelook Start Sample Number -
This parameter indicates the sample number the instrument's flight code will begin summing radiance count values for determining the internal spacelook average. The default value is set = 5 for all three channels. This value can only be changed in conjunction with a DAP_Scan_Table_Load long command.

DS-85 Bridge Balance Spacelook End Sample Number -
This parameter indicates the sample number the instrument's flight code will begin summing radiance count values for determining the internal spacelook average. The default value is set = 25 for all three channels. This value can only be changed in conjunction with a DAP_Scan_Table_Load long command.

DS-86 Bridge Balance DAC Update Sample Number -
This parameter indicates the sample number the instrument's flight code will begin summing radiance count values for determining the internal spacelook average. The default value is set = 644. However, the DAC updating process will actually require six samples, for a range of 644..649 for all three channels. This value can only be changed in conjunction with a DAP_Scan_Table_Load long command.

DS-87 Bridge Balance Window High Value -
This parameter indicates the upper edit limit count value for the spacelook averaging process used to determine if a bridge balance update should occur. The default value is set = 300 for all three channels. This value can only be changed in conjunction with a DAP_Scan_Table_Load long command.

DS-88 Bridge Balance Window Low Value -

This parameter indicates the upper edit limit count value for the spacelook averaging process used to determine if a bridge balance update should occur. The default value is set = 50 for all three channels. This value can only be changed in conjunction with a DAP_Scan_Table_Load long command.

DS-89 Bridge Balance Window Setpoint Value -
This parameter indicates the target spacelook average count value when the spacelook averaging process performs a bridge balance update. The default value is set = 225 for all three channels. This value can only be changed in conjunction with a DAP_Scan_Table_Load long command.

DS-90 Total Detector Temperature Setpoint -
This parameter indicates the current temperature setpoint (in counts) that was last commanded to the heatsink temperature controller. The default value is 2048 (the middle of the 12 bit range). This value can be changed with the SET_TOT_SENSOR_TEMP_SETPOINT command.

DS-91 Total Detector Temperature Control Status -
This parameter indicates if the detector heatsink temperature controller is on or off. Table 4-19, note 100. The normal default is on. This status can be changed using the SET_TOT_SENSOR_TEMP_CONTROL command.

DS-92 SW Detector Temperature Setpoint -
This parameter indicates the current temperature setpoint (in counts) that was last commanded to the heatsink temperature controller. The default value is 2048 (the middle of the 12 bit range). This value can be changed with the SET_SW_SENSOR_TEMP_SETPOINT command.

DS-93 SW Detector Temperature Control Status -
This parameter indicates if the detector heatsink temperature controller is on or off. See Table 4-19, note 100. The normal default is on. This status can be changed using the SET_SW_SENSOR_TEMP_CONTROL command.

DS-94 WN Detector Temperature Setpoint -
This parameter indicates the current temperature setpoint (in counts) that was last commanded to the heatsink temperature controller. The default value is 2048 (the middle of the 12 bit range). This value can be changed with the SET_SW_SENSOR_TEMP_SETPOINT command.

DS-95 WN Detector Temperature Control Status -
This parameter indicates if the detector heatsink temperature controller is on or off. See Table 4-19, note 100. The normal default is on. This status can be changed using the SET_WN_SENSOR_TEMP_CONTROL command.

DS-96 Blackbody Temperature Setpoint -
This parameter indicates the current commanded temperature setpoint for the blackbody internal calibration source. The setpoint is keyed to the total blackbody channel, with the longwave channel ganged to the total channel. The defaulted values are typically in counts corresponding to a off (0), low (1550), medium (2650), and high (3750) setting. These count values correspond roughly to ~ 12.06, 31.88, 52.11 degree C, respectively. This status value will reflect changes in the SET_BLACKBODY_TEMP_SETPOINT command.

DS-97 Blackbody Temperature Control Status -
This parameter indicates if the blackbody heatsink temperature controller is on or off. See Table

4-19, note 100. The normal default is off. This status can be changed using the SET_BLACKBODY_SENSOR_TEMP_CONTROL command.

DS-98 SWICS Intensity Level -
This parameter indicates the intensity level of the SWICS calibration source for the current packet. See Table 4-19, note 103. The default value is 0 (off). This status can be changed using the SET_SWICS_INTENSITY command. The Low, Medium, and High settings correspond roughly to 100, 250, and 400 $Wm^{-2}sr^{-1}$, respectively.

DS-99 Elevation Scan Mode -
This parameter indicates the status of the elevation gimbal scanning profile for the current packet as of the last sample in the current packet. See Table 4-19, note 108. Since elevation operations always begin and end on packet boundaries, this status will reflect the commanded scan profile that was implemented for the current packet and will be a reflection of the SET_SCAN_MODE command. Nominal parameter index values should range from 0 (stow) to 4 (nadir). The remaining index values are for ground testing only and should not be expected to be used on-orbit. The various profiles are shown in Table 4-3. Note, the stow position can be changed by the Set_Elevation_Stow_Pos command, though this is not expected to be used on-orbit.

DS-100 Elevation On Deck Scan Mode -
This parameter indicates the scan (profile) mode that is to be implemented at the beginning of the next packet. Table 4-19, note 108. This status reflects operations as of the last sample in the packet. This value is typically a direct reflection of the command SET_SCAN_MODE. Nominal parameter index values should range from 0 (stow) to 4 (nadir). The remaining index values are for ground testing only and should not be expected to be used on-orbit. See Table 4-20 for details on elevation gimbal operations.

DS-101 Elevation Scan Status -
This parameter indicates the status of elevation scan operations for the current packet as of the last sample. See Table 4-19, note 109. Since elevation operations always begin and end on packet boundaries, this status will reflect the gimbal operations for the whole packet. During nominal scanning, this status value should be 0 (Normal_Scan_Operations). During transitions between profiles (e.g. Stow to Normal Earth Scan), this status will most likely indicate 2 (At_Initialized_Position). See Table 4-20 for details on elevation gimbal operations.

DS-102 Elevation Motor Drive -
This parameter indicates whether the elevation gimbal motor is enabled or disabled as of the last sample in the packet. See Table 4-19, note 115. The motor will automatically be disabled whenever the elevation gimbal is in the stow position. Otherwise, it should be enabled.

DS-103 Elevation Encoder LED Intensity -
This parameter indicates whether the LED used to read the elevation gimbal encoder is set to a low or high power setting as of the last sample in the current packet. See Table 4-19, note 110. The normal condition is a low (0) setting. Over time, environmental conditions are expected to degrade the LED's optical power output which will require the power to be set to high the SET_ELEVATION_ENCODER_LED command.

DS-104 Elevation Stall -
This parameter indicates if the elevation gimbal has stalled during the current packet. Table 4-19,

note 136. Stalling occurs whenever the number of encoder counts that exceeds the commanded count (i.e. the difference value) by the Azimuth Stall Error Threshold AND this condition has occurred for more than Azimuth Stall Count Threshold (samples). When a stall occurs the azimuth will be internally commanded to stop and the Azimuth Mode should indicate Stop_Azimuth.

DS-105 Elevation Offset Correction (CDD - 1) -
This parameter indicates an internal count adjustment to compensate for the encoder position to actual gimbal position misalignment. This value will reflect the internal default value or the last update by the Set_Elevation_Offset_Correction command. The converted value is computed using DRL-64 (Reference 8) algorithm 4 Linear Coefficients listed in Table 8-3 Sub-type K.

DS-106 Elevation Stall Error Threshold -
This parameter indicates the defined count threshold for the difference between the commanded gimbal position and the actual gimbal position that would indicate a possible gimbal stall condition. The default value is 32767 and can be changed with the SET_ELEVATION_STALL_ERROR_THRESHOLD command. When this threshold and the Elevation Stall Count Threshold are both tripped, the elevation gimbal will be internally commanded to stop ??? and the stall status indicator set.

DS-107 Elevation Stall Count Threshold -
This parameter indicates the defined threshold for the number of samples the elevation gimbal position error exceeds the Elevation Stall Error Threshold. The default value is 660 samples and can be changed with the SET_ELEVATION_STALL_COUNT_THRESHOLD command. When this threshold and the Elevation Stall Error Threshold are both tripped, the Elevation gimbal will be internally commanded to stop ??? and the stall status indicator set.

DS-108 Elevation Position Error Sample 1 -
This parameter indicates the count value corresponding to the difference between the commanded elevation position and the actual encoder position. While this position error value is computed for every sample, a value is output here that corresponds to sample number 120 (of samples 0..659).

DS-109 Elevation Position Error Sample 2 -
This parameter indicates the count value corresponding to the difference between the commanded elevation position and the actual encoder position. While this position error value is computed for every sample, a value is output here that corresponds to sample number 336 (of samples 0..659).

DS-110 Elevation Position Error Sample 3 -
This parameter indicates the count value corresponding to the difference between the commanded elevation position and the actual encoder position. While this position error value is computed for every sample, a value is output here that corresponds to sample number 505 (of samples 0..659).

DS-111 Main Cover Command -
This parameter indicates the last command that was directed to the main cover assembly. See Table XXX, note 104. During nominal mission operations, this status should generally indicate Cover_Stop (0) or Cover_Open (1). This status will reflect the COMMAND_COVER_MAIN, STEP_MAIN_COVER_TO_OPEN, or STEP_MAIN_COVER_TO_CLOSE commands. There are no plans to close the cover after initial on-orbit instrument checkout.

DS-112 Main Cover Motion Status -
This parameter indicates the motion status of the main cover during the current packet as of the last

sample. See Table 4-19, note 105. During nominal mission operations, this status should generally indicate Cover_Stopped (0). There are no plans to move the cover after initial on-orbit instrument checkout.

DS-113 Main Cover Position Status -
This parameter indicates where the cover is currently positioned as of the last sample in the packet. See Table 4-19, note 106. During nominal mission operations, this status should generally indicate Cover_At_Opened_Position (1). However, it may also indicate Potentailly_Failed_Position_Sensor. This indicator simply means that the cover "overshot" its defined opened (or closed) position and is not indicative of a problem. There are no plans to move the cover after initial on-orbit instrument checkout.

DS-114 Main Cover Sensor Active -
This parameter indicates which of the two position sensors is being used to measure the cover position. See Table 4-19, note 107. The default is sensor_1 (0). There are two sensors, one for each turnscrew rail and are used during cover motion to sense possible difference drive signals that could cause racking (stalling) by the covers. This status will reflect changes to the SET_MAIN_COVER_ACTIVE_POSITION_SENSOR command.

DS-115 Main Cover Commanded Position -
This parameter indicates the raw count position the cover was commanded to as of the last sample in the packet. During nominal mission operations, this is expected to correspond to the opened, defined position within defined margins. This status may also reflect fixed stepped commanded positions.

DS-116 Main Cover Accumulated Lag Error Sensor 1 -
This parameter indicates the difference between the actual cover position and the incremental commanded position during cover motions as of the last sample in the packet. This difference is measured for sensor 1 and is used for determining possible stalling conditions. Note, stalling conditions are determined in part by when this error value exceeds the internal default value or the value set by the Set_Main_Cover_Sensor_1_Lag_Error command. During nominal mission operations, this value is generally ignored.

DS-117 Main Cover Accumulated Lag Error Sensor 2 -
This parameter indicates the difference between the actual cover position and the incremental commanded position during cover motions as of the last sample in the packet. This difference is measured for sensor 2 and is used for determining possible stalling conditions. Note, stalling conditions are determined in part by when this error value exceeds the internal default value or the value set by the Set_Main_Cover_Sensor_2_Lag_Error command. During nominal mission operations, this value is generally ignored.

DS-118 Main Cover Fixed Step Count -
This parameter indicates the current raw count position as of the last sample in the packet for any fix stepping commanding actions. During nominal mission operations, this value is expected to be zero.

DS-119 Main Cover Defined Closed Position -
This parameter indicates a Main Cover fixed closed position setpoint. Its default value corresponds to 241 counts for position sensor 1. This default value can be only be changed with a memory patch

long command. (See Flight Code Memory Patches)

DS-120 Main Cover Defined Open Position -
This parameter indicates a Main Cover fixed opened position setpoint. Its default value corresponds to 3164 counts for position sensor 1. This default value can be only be changed with a memory patch long command. (See Flight Code Memory Patches)

DS-121 Main Cover Defined Closed Margin -
This parameter indicates a Main Cover fixed position allowable margin about the predefined close setpoint. Its default value corresponds to 30 counts for both position sensors 1 and 2. This default value can be only be changed with a memory patch long command. (See Flight Code Memory Patches)

DS-122 Main Cover Defined Open Margin -
This parameter indicates a Main Cover fixed position allowable margin about the predefined open setpoint. Its default value corresponds to 30 counts for both position sensors 1 and 2. This default value can be only be changed with a memory patch long command. (See Flight Code Memory Patches)

DS-123 MAM Cover Command -
This parameter indicates the last command that was directed to the MAM cover assembly. See Table 4-19, note 104. During nominal mission operations, this status should generally indicate Cover_Open or Cover_Stop. This status will reflect the COMMAND_COVER_MAM, STEP_MAM_COVER_TO_OPEN, or STEP_MAM_COVER_TO_CLOSE commands. There are no plans to close the cover after initial on-orbit instrument checkout.

DS-124 MAM Cover Motion Status -
This parameter indicates the motion status of the MAM cover during the current packet as of the last sample. See Table 4-19, note 105. During nominal mission operations, this status should generally indicate Cover_Stopped (0). There are no plans to move the cover after initial on-orbit instrument checkout.

DS-125 MAM Cover Position Status -
This parameter indicates where the cover is currently positioned as of the last sample in the packet. See Table XXX, note 106. During nominal mission operations, this status should generally indicate Cover_At_Opened_Position (1). However, it may also indicate Potentailly_Failed_Position_Sensor. This indicator simply means that the cover “overshot” its defined opened (or closed) position and is not indicative of a problem. There are no plans to move the cover after initial on-orbit instrument checkout.

DS-126 MAM Cover Sensor Active -
This parameter indicates which position sensor is being used to measure the cover position. See Table 4-19, note 107. The default is sensor_1 (0) as there is only one sensor used for the MAM cover assembly.

DS-127 MAM Cover Commanded Position -
This parameter indicates the raw count position the cover was commanded to as of the last sample in the packet. During nominal mission operations, this is expected to correspond to the opened, defined position within defined margins. This status may also reflect fixed stepped commanded positions.

DS-128 MAM Cover Fixed Step Count -
This parameter indicates the current raw count position as of the last sample in the packet for any fix stepping commanding actions. During nominal mission operations, this value is expected to be zero.

DS-129 MAM Cover Defined Closed Position -
This parameter indicates a MAM Cover fixed closed position setpoint. Its default value corresponds to 801 counts. This default value can be only be changed with a memory patch long command. (See Flight Code Memory Patches)

DS-130 MAM Cover Defined Open Position -
This parameter indicates a MAM Cover fixed opened position setpoint. Its default value corresponds to 1924 counts. This default value can be only be changed with a memory patch long command. (See Flight Code Memory Patches)

DS-131 MAM Cover Defined Closed Margin -
This parameter indicates a MAM Cover fixed position allowable margin about the predefined close setpoint. Its default value corresponds to 20 counts. This default value can be only be changed with a memory patch long command. (See Flight Code Memory Patches)

DS-132 MAM Cover Defined Open Margin -
This parameter indicates a MAM Cover fixed position allowable margin about the predefined open setpoint. Its default value corresponds to 20 counts. This default value can be only be changed with a memory patch long command. (See Flight Code Memory Patches)

DS-133 DAP Watchdog Boot Status-
This parameter indicates whether an instrument reset was caused by the DAP watch dog timer or by normal power up. See Table 4-19, note 127. Default is normal power up.

DS-134 DAP Watchdog Enable Status-
This parameter indicates whether the watchdog time will generate an instrument reset on the DAP. See Table 4-19, note 128. This is commanded using the SET_WATCHDOG_TIMER_DAP command. Default is armed. Note that should a reset occur, the instrument recovery procedures should be the same as power-up and the watchdog timer re-armed.

DS-135 DAP PROM Power Status-
This parameter indicates if the PROM power is on or off. See Table 4-19, note 129. Normally the PROMs are off except for initial power up. It is expected that within the first packet or two, this status will switch to off. PROM power can be enabled by the SET_PROM_POWER_DAP command.

DS-136 DAP Sample Clock Interrupt Occurred -
This parameter is an internal instrument flight code only parameter and should always indicate zero.

DS-137 DAP Processor Scan Period Count -
This parameter indicates the scan period counter associated with the execution of an internal sequence operation. This counter is reset to zero at the start of a sequence and will update at each scan for the duration of the execution time. The count value at the end of a sequence will remain until another sequence is executed.

DS-138 DAP Memory Dump Start Address Offset -
This parameter indicates the offset portion (lower 16 of 20 bits) of memory address corresponding to a memory dump data word for the beginning of a packet. For the first packet at the beginning of a memory dump, this parameter map reflect the SET_MEM_DUMP_START_OFFSET_DAP command. Thereafter, it will be an incremental value.

DS-139 DAP Memory Dump Start Address Segment -
This parameter indicates the offset portion (upper 4 of 20 bits) of memory address corresponding to a memory dump data word for the beginning of a packet. For the first packet at the beginning of a memory dump, this parameter map reflect the SET_MEM_DUMP_START_SEGMENT_DAP command. Thereafter, it will be an incremental value.

DS-140 DAP Memory Dump End Address Offset -
This parameter indicates the offset portion (lower 16 of 20 bits) of memory address corresponding to a memory dump data word for the end of a packet. For the last packet at the end of a memory dump, this parameter map reflect the SET_MEM_DUMP_END_OFFSET_DAP command. During a dump, it will be an incremental value.

DS-141 DAP Memory Dump End Address Segment -
This parameter indicates the offset portion (upper 4 of 20 bits) of memory address corresponding to a memory dump data word for the end of a packet. For the last packet at the end of a memory dump, this parameter map reflect the SET_MEM_DUMP_END_SEGMENT_DAP command. During a dump, it will be an incremental value.

DS-142 DAP Packet Start Address Offset -
This parameter indicates the offset portion (lower 16 of 20 bits) of the active memory address used by the flight code at the beginning of a packet. This value will vary from packet to packet.

DS-143 DAP Packet Start Address Segment -
This parameter indicates the offset portion (upper 4 of 20 bits) of the active memory address used by the flight code at the beginning of a packet. This value will vary from packet to packet.

DS-144 DAP Address Changes Indicator -
This parameter is an internal instrument flight code only parameter and should always indicate zero.

DS-145 DAP Minimum Execution Time (CDD-14) -
This parameter shows the shortest execution time among the 660 DAP software polling loops per packet. Nominally, this is expected to be in the range of 2-3 milliseconds. The converted value is computed using DRL-64 (Reference 8) algorithm 4 Linear Coefficients listed in Table 8-3 Sub-type N.

DS-146 DAP Minimum Sample Number -
This parameter indicates which sample during the packet when the shortest DAP execution time occurred. The typical range is 0..659.

DS-147 DAP Maximum Execution Time (CDD-15) -
This parameter shows the longest execution time among the 660 ICP software polling loops per packet. Nominally, this is expected to be in the range of 5-6 milliseconds. The converted value is computed using DRL-64 (Reference 8) algorithm 4 Linear Coefficients listed in Table 8-3 Sub-

type N.

DS-148 DAP Maximum Sample Number -
This parameter indicates which sample during the packet when the longest DAP execution time occurred. The typical range is 0..659.

DS-149 DAP RAM Code Checksum -
This parameter indicates the internally computed checksum value for the DAP RAM (Random Access Memory) code. This value is updated whenever new memory patches are loaded using the DAP_Memory_Load, DAP_Unique_Data_Load, or DAP_Scan_Table_Load long commands. Updates to the instrument memory are expected after every power-on or reset. See Flight Code Memory Patches for more details.

DS-150 DAP ROM Code Checksum -
This parameter indicates the internally computed checksum value for the DAP ROM (Read Only Memory) code. This value is based on the preprogrammed flight code and is not expected to change. It will however, be different for each instrument.

DS-151 Azimuth Mode -
This parameter indicates the configuration status of the azimuth gimbal action for the current packet. See Table 4-19, note 111. This status will generally reflect that the azimuth is going to a Goto_x position, performing and A_B slewing operation, or is stopped. When the instrument is in the nominal Crosstrack mode, this parameter should indicate Goto_Position_Crosstrack. For the nominal Biaxial mode, this parameter should indicate Scan_A_B_Asynchronously. This parameter will generally reflect the Command_Azimuth_Goto_Position command upon completing execution. Upon any power up or reset conditions, this status should indicate Initialized.

DS-152 Azimuth Motion Status -
This parameter indicates the motion of the azimuth gimbal as of the last sample in the current packet. See Table 4-19, note 112. Note that this parameter does NOT provide any indication of azimuth motion during the packet (i.e., stopped at the beginning of the packet and then started moving in the middle and vice-versa).

DS-153 Azimuth Direction Status -
This parameter indicates the direction the azimuth gimbal was moving as of the last sample in the current packet. See Table 4-19, note 113. Whenever the gimbal is not moving, this parameter will normally indicate a forward direction. Forward direction is indicated with increasing encoder angles. Note that this parameter does NOT provide any indication of azimuth direction during the packet (i.e., stopped or turned around at an A_B slew point).

DS-154 Azimuth Position Status -
This parameter indicates the azimuth gimbal position as of the last sample in the current packet. See Table 4-19, note 114. When the instrument is in the nominal Crosstrack mode, this parameter should indicate At_Goto_Position. For the nominal Biaxial mode, this parameter should indicate In_Motion. When the azimuth has transitioned to a A_B start point, it should indicate At_Scan_Position [IS THIS REALLY HAPPENING PER MISSION SIMULATIONS?????]. Should the azimuth be commanded to stop, this parameter should indicate At_Stopped_Position.

DS-155 Azimuth Motor Drive Status -

This parameter indicates whether the azimuth gimbal is enabled or disabled as of the last sample in the current packet. See Table 4-19, note 115. The normal condition is enabled except during safing conditions. [ANY OTHER CONDITIONS???] The azimuth drive is not commandable via short commands. ?????

DS-156 Azimuth Encoder LED Status -
This parameter indicates whether the LED used to read the azimuth gimbal encoder is set to a low or high power setting as of the last sample in the current packet. See Table 4-19, note 110. The normal condition is a low setting. Over time, environmental conditions are expected to degrade the LED's optical power output which will require the power to be set to high the SET_AZIMUTH_ENCODER_LED command.

DS-157 Azimuth Stall -
This parameter indicates if the azimuth gimbal has stalled during the current packet. See Table 4-19, note 136. Stalling occurs whenever the number of encoder counts that exceeds the commanded count (i.e. the difference value) by the Azimuth Stall Error Threshold AND this condition has occurred for more than Azimuth Stall Count Threshold (samples). When a stall occurs the azimuth will be internally commanded to stop and the Azimuth Mode should indicate Stop_Azimuth.

DS-158 Azimuth Defined Crosstrack Position (CDD-3) -
This parameter indicates an azimuth gimbal fixed position setpoint. Its default value corresponds to 180 degrees. The converted value is computed using DRL-64 (Reference 8) algorithm 4 Linear Coefficients listed in Table 8-3 Sub-type K. This default value can be changed with the SET_AZIMUTH_FIXED_CROSSTRACK command.

DS-159 Azimuth Defined Fixed Position A (CDD-4) -
This parameter indicates an azimuth gimbal fixed position setpoint. Its default value corresponds to 90 degrees (Normal Scan). This is the typical starting point for a rotating azimuth (biaxial) scan. However, during solar avoidance operations involving low solar Beta angles, this value will be changed by the SET_AZIMUTH_FIXED_POSITION_A command to a corresponding 110 degrees (Short Scan). The converted value is computed using DRL-64 (Reference 8) algorithm 4 Linear Coefficients listed in Table 8-3 Sub-type K.

DS-160 Azimuth Defined Fixed Position B (CDD-5) -
This parameter indicates an azimuth gimbal fixed position setpoint. Its default value corresponds to 270 degrees (Normal Scan). This is the typical ending point for a rotating azimuth (biaxial) scan. However, during solar avoidance operations involving low solar Beta angles, this value will be changed by the SET_AZIMUTH_FIXED_POSITION_B command to a corresponding 250 degrees (Short Scan). The converted value is computed using DRL-64 (Reference 8) algorithm 4 Linear Coefficients listed in Table 8-3 Sub-type K.

DS-161 Azimuth Defined Fixed Solar Calibration Position (CDD-6) -
This parameter indicates an azimuth gimbal fixed position setpoint. Its default value corresponds to 105 degrees. This position is used to orient the instrument so that the MAM aperture opening will face the sun during a solar calibration event. Note: This default value is expected to be changed with the SET_AZIMUTH_FIXED_SOLARCAL command to 180 degrees immediately following any instrument power-ups or resets. During normal mission operation solar calibrations, this fixed azimuth position will be changed to point the instrument's MAM port in the direction of the solar azimuth position that is derived from orbital planning aids. Depending on which quadrant

the sun position is located, this value is typically less than 90 degrees or more than 270 degrees (VERIFY THIS!!!!). The converted value is computed using DRL-64 (Reference 8) algorithm 4 Linear Coefficients listed in Table 8-3 Sub-type K.

DS-162 Azimuth Defined Fixed Cage Position (CDD-7) -
This parameter indicates an azimuth gimbal fixed position setpoint. Its default value corresponds to approximately 0.1 degrees. The converted value is computed using DRL-64 (Reference 8) algorithm 4 Linear Coefficients listed in Table 8-3 Sub-type K. This default value can be changed with the SET_AZIMUTH_FIXED_CAGED command.

DS-163 Azimuth Defined Fixed Position Spare 1 (CDD-8) -
This parameter indicates an azimuth gimbal fixed position setpoint. Its default value corresponds to approximately 45 degrees. The converted value is computed using DRL-64 (Reference 8) algorithm 4 Linear Coefficients listed in Table 8-3 Sub-type K. This default value can be changed with the SET_AZIMUTH_FIXED_SPARE_1 command.

DS-164 Azimuth Defined Fixed Position Spare 2 (CDD--9) -
This parameter indicates an azimuth gimbal fixed position setpoint. Its default value corresponds to approximately 165 degrees. During mission operations, this parameter is planned to be used for contamination safing operations. The converted value is computed using DRL-64 (Reference 8) algorithm 4 Linear Coefficients listed in Table 8-3 Sub-type K. This default value can be changed with the SET_AZIMUTH_FIXED_SPARE_2 command.

DS-165 Azimuth Defined Fixed Position Spare 3 (CDD-10) -
This parameter indicates an azimuth gimbal fixed position setpoint. Its default value corresponds to approximately 329 degrees. The converted value is computed using DRL-64 (Reference 8) algorithm 4 Linear Coefficients listed in Table 8-3 Sub-type K. This default value can be changed with the SET_AZIMUTH_FIXED_SPARE_3 command.

DS-166 Azimuth Defined Normal Slew Rate (CDD-11) -
This parameter indicates an azimuth gimbal rotating slewing rate for motions typically involving Goto_Position_X operations. Its default value corresponds to approximately 6 degrees/second. The converted value is computed using DRL-64 (Reference 8) algorithm 7. This default value can be changed with the SET_AZIMUTH_RATE_GOTO_RATE command.

DS-167 Azimuth Defined Asynchronous Scan Rate (CDD-12) -
This parameter indicates an azimuth gimbal asynchronously rotating slewing rate for the nominal Biaxial science mode. An Asynchronous slew is defined as scanning between two points with no synchronization to any clocks, commands, or packet boundaries. (Refer to figure XXX for example slewing pattern.) Its default value corresponds to approximately 5 degrees/second. Note: This default value is expected be changed with the SET_AZIMUTH_RATE_ASYNC_RATE command to 6 degrees/second immediately following any instrument power-ups or resets. The converted value is computed using DRL-64 (Reference 8) algorithm 7.

DS-168 Azimuth Defined Synchronous Scan Rate (CDD-13) -
This parameter indicates an azimuth gimbal synchronously rotating slewing rate for an optional Biaxial science mode. A Synchronous slew is defined as scanning between two points where upon reaching an end point, the azimuth will hold at that position until the beginning of the next packet boundary. (Refer to figure XXX for example slewing pattern.) Its default value corresponds to

approximately 4 degrees/second. The converted value is computed using DRL-64 (Reference 8) algorithm 7. This default value can be changed with the SET_AZIMUTH_RATE_SYNC_RATE command.

DS-169 Azimuth Offset Correction (CDD - 2) -
This parameter indicates an internal count adjustment to compensate for the encoder position to actual gimbal position misalignment. The converted value is computed using DRL-64 (Reference 8) algorithm 4 Linear Coefficients listed in Table 8-3 Sub-type K.. This value will reflect the internal default value or the last update by the SET_AZIMUTH_OFFSET_CORRECTION command.

DS-170 Azimuth Stall Error Threshold -
This parameter indicates the defined count threshold for the difference between the commanded gimbal position and the actual gimbal position that would indicate a possible gimbal stall condition. The default value is 500 and can be changed with the SET_AZIMUTH_STALL_ERROR_THRESHOLD command. When this threshold and the Azimuth Stall Count Threshold are both tripped, the azimuth gimbal will be internally commanded to stop and the stall status indicator set.

DS-171 Azimuth Stall Count Threshold -
This parameter indicates the defined threshold for the number of samples the azimuth gimbal position error exceeds the Azimuth Stall Error Threshold. The default value is 10 samples and can be changed with the SET_AZIMUTH_STALL_COUNT_THRESHOLD command. When this threshold and the Azimuth Stall Error Threshold are both tripped, the azimuth gimbal will be internally commanded to stop and the stall status indicator set.

DS-172 Brake Command Status -
This parameter indicates the last command that was sent to the brake assembly. See Table 4-19, note 116. During nominal science operations, this status should generally indicate Release. During safing operations, this status should generally indicate either apply or stop. The Fixed_Step_To_Cage/Apply are expected to be used only when mechanical difficulties occur. This status parameter will reflect any changes made by the following commands: COMMAND_BRAKE, STEP_BRAKE_TO_CAGED, or STEP_BRAKE_TO_APPLIED.

DS-173 Brake Motion Status -
This parameter indicates the motion of the brake assembly for the current packet as of the last sample. See Table 4-19, note 117. During nominal science operations, this status should generally indicate Stopped. During safing operations, this status generally indicate applying (going into a safing operation), releasing (going back to science operations), or stopped.

DS-174 Brake Position Status -
This parameter indicates the position of the brake assembly for the current packet as of the last sample. See Table 4-19, note 118. During nominal science operations, this status should generally indicate At_Released_Position. During safing operations, this status should generally indicate At_Applied_Position. *Note: the brake assembly is essentially a rocker arm that pivots about a center point. When one end is placed against the azimuth gimbal, the brake will be applied. When the other end is placed against the azimuth assembly, the brake will be caged (but only if the azimuth is at the predefined cage position). When neither ends are placed against the azimuth assembly, the brake is in its released position.

DS-175 Brake Commanded Position -
This parameter indicates the position count value the brake assembly was commanded to within the current packet. During nominal operations, this value will reflect one of the predefined fixed positions (typ. released or applied). During any stepping operations, this value will reflect the position commanded to by the ground controller.

DS-176 Brake Current Position -
This parameter indicates the position of the brake (in counts) for the current packet as of the last sample. During normal science operations, this value should correspond to the predefined release position, plus or minus the release position margin. During safing operations, this position value should correspond to the predefined applied position, plus or minus the applied position margin.

DS-177 Brake Position SUBMUX Channel -
This parameter indicates the instruments submultiplexer channel for the current packet as of the last sample in the packet. Each channel corresponds to a given analog sensor to be sampled by the Analog to Digital Converter (ADC) and placed in the packet based on the packet format and sample number. This value is expected to be 163, the designated channel for the brake position sensor.

DS-178 Brake Step Count -
This parameter indicates the current brake position (in counts) as of the last sample in the packet. This count is active whenever the brake has been commanded to perform fixed step operations, otherwise this value should correspond to 0.

DS-179 Brake Defined Released Position -
This parameter indicates a brake fixed released position setpoint. Its default value corresponds to 800 counts. This default value can be only be changed with a memory patch long command. (See Flight Code Memory Patches)

DS-180 Brake Defined Applied Position -
This parameter indicates a brake fixed applied position setpoint. Its default value corresponds to 685 counts. This default value can be only be changed with a memory patch long command. (See Flight Code Memory Patches)

DS-181 Brake Defined Cage Position -
This parameter indicates a brake fixed caged position setpoint. Its default value corresponds to 1027 counts. This default value can be only be changed with a memory patch long command. (See Flight Code Memory Patches)

DS-182 Brake Defined Released Margin -
This parameter indicates a brake fixed position allowable margin about the predefined released setpoint. Its default value corresponds to 50 counts. This default value can be only be changed with a memory patch long command. (See Flight Code Memory Patches)

DS-183 Brake Defined Applied Margin -
This parameter indicates a brake fixed position allowable margin about the predefined applied setpoint. Its default value corresponds to 5 counts. This default value can be only be changed with a memory patch long command. (See Flight Code Memory Patches)

DS-184 Brake Defined Cage Margin -
This parameter indicates a brake fixed position allowable margin about the predefined caged

setpoint. Its default value corresponds to 5 counts. This default value can be only be changed with a memory patch long command. (See Flight Code Memory Patches)

DS-185 Azimuth Position Error Value -
This parameter indicates the gimbal controller error (commanded versus actual difference) for a selected sample. ???

The next four (4) status parameters are unique to the CERES instrument on the TRMM spacecraft:

DS-186 Safehold Input A Status -
This parameter indicates if the instrument has been commanded into a safing condition by a signal sent via the spacecraft's safehold bus A. See Table 4-19, note 125. The normal default is 0 (Normal_Operations). The instrument will respond to this signal only if the safehold response for the A bus has been enabled.

DS-187 Safehold Input B Status -
This parameter indicates if the instrument has been commanded into a safing condition by a signal sent via the spacecraft's safehold bus B. See Table 4-19, note 125. The normal default is 0 (Normal_Operations). The instrument will respond to this signal only if the safehold response for the A bus has been enabled.

DS-188 Safehold Response A Status -
This parameter indicates whether the instrument will respond to a safe-hold pulse on the A input side. See Table 4-19, note 126. The response is set by the SET_SAFE_HOLD_RESPONSE_A command and responds immediately to this command. The normal default is Enable. Note that one of the two safehold responses must be enabled at all times for safety reasons.

DS-189 Safehold Response B Status -
This parameter indicates whether the instrument will respond to a safe-hold pulse on the B input side. See Table 4-19, note 126. The response is set by the SET_SAFE_HOLD_RESPONSE_B command and responds immediately to this command. The normal default is Enable. Note that one of the two safehold responses must be enabled at all times for safety reasons.

The next seven (7) statuses are unique to the CERES instruments on the EOS-AM spacecraft.

DS-190 Low Rate Science Transfer Status -
This parameter indicates if the low rate science transfer interface bus is enabled or disabled. See Table 4-19, note 144. The default is 0 (Enabled). This parameter reflects the LOW_RATE_SCIENCE_TRANSFER_ENABLE command.

DS-191 Safemode Signal Received -
This parameter indicates if the instrument has been commanded into a safe condition by the spacecraft's safing interface. See Table 4-19, note 144. The normal default is 0 (Signal_Not_Received).

DS-192 Safemode Signal Response -
This parameter indicates if the instrument has responded to the Safemode Signal from spacecraft's safing interface by safing itself. See Table 4-19, note 143. The normal default is 1 (Enabled).

DS-193 IMOK Signal Received -

This parameter indicates if the instrument has received an IMOK (pronounced “I’m Ok”) signal from the spacecraft’s interface. See Table 4-19, note 145. The normal default is 0 (Signal_Received).

DS-194 IMOK Signal Response -
This parameter indicates if the instrument has responded to the IMOK (pronounced “I’m Ok”) Signal Received from the spacecraft’s interface. See Table 4-19, note 143. The normal default is 1 (Enabled). This parameter reflects the SET_IMOK_SIGNAL_RESPONSE command. This signal is used in conjunction with spacecraft safing conditions.

DS-195 Time Mark & Frequency Bus Select -
This parameter indicates which spacecraft timing bus to use for the packet time stamp. See Table 4-19, note 146. The default is 0 (Bus_A_Selected). This parameter reflects the SELECT_TIME_MARK_FREQUENCY_BUS command.

DS-196 Time Mark & Frequency Interrupt -
This parameter indicates a spacecraft timing bus interruption has occurred. See Table 4-19, note 147. The default is 0 (No_Time_Frequency_Interrupt). This parameter reflects the SET_TIME_MARK_FREQUENCY_RESPONSE command.

DS-197 ICP Watchdog Boot Status-
This parameter indicates whether an instrument reset was caused by the DAP watch dog timer or by normal power up. See Table 4-19, note 147. Default is normal power up.

DS-198 ICP Watchdog Enable Status-
This parameter indicates whether the watchdog time will generate an instrument reset on the ICP. See Table 4-19, note 128. This is commanded using the SET_WATCHDOG_TIMER_ICP command. Default is armed. Note that should a reset occur, the instrument recovery procedures should be the same as power-up and the watchdog timer re-armed.

DS-199 ICP PROM Power Status-
This parameter indicates if the PROM power is on or off. See Table 4-19, note 129. Normally the PROMs are off except for initial power up. It is expected that within the first packet or two, this status will switch to off. PROM power can be enabled by the SET_PROM_POWER_ICP command.

DS-200 ICP Sample Clock Interrupt Occurred -
This parameter is an internal instrument flight code only parameter and should always indicate zero.

DS-201 DMA Communication Status -
This parameter indicates the status of the ICP-to-DAP DMA (Direct Memory Access) activity as of the last sample for the current packet. See Table 4-19, note 138. The DMA is under the control of the ICP and is the primary mechanism for transferring commands and data between the two processors.

DS-202 ICP Scan Period Counter -
This parameter indicates the scan period counter associated with the execution of an internal sequence operation. This counter is reset to zero at the start of a sequence and will update at each scan for the duration of the execution time. The count value at the end of a sequence will remain

until another sequence is executed.

DS-203 ICP Memory Dump Start Address Offset -
This parameter indicates the offset portion (lower 16 of 20 bits) of memory address corresponding to a memory dump data word for the beginning of a packet. For the first packet at the beginning of a memory dump, this parameter map reflect the SET_MEM_DUMP_START_OFFSET_ICP command. Thereafter, it will be an incremental value. (See memory usage Table 4-22 for details.)

DS-204 ICP Memory Dump Start Address Segment -
This parameter indicates the offset portion (upper 4 of 20 bits) of memory address corresponding to a memory dump data word for the beginning of a packet. For the first packet at the beginning of a memory dump, this parameter map reflect the SET_MEM_DUMP_START_SEGMENT_ICP command. Thereafter, it will be an incremental value. (See memory usage Table 4-22 for details.)

DS-205 ICP Memory Dump End Address Offset -
This parameter indicates the offset portion (lower 16 of 20 bits) of memory address corresponding to a memory dump data word for the end of a packet. For the last packet at the end of a memory dump, this parameter map reflect the SET_MEM_DUMP_END_OFFSET_ICP command. During a dump, it will be an incremental value. (See memory usage Table 4-22 for details.)

DS-206 ICP Memory Dump End Address Segment -
This parameter indicates the offset portion (upper 4 of 20 bits) of memory address corresponding to a memory dump data word for the end of a packet. For the last packet at the end of a memory dump, this parameter map reflect the SET_MEM_DUMP_END_SEGMENT_ICP command. During a dump, it will be an incremental value. (See memory usage Table 4-22 for details.)

DS-207 ICP Packet Start Address Offset -
This parameter indicates the offset portion (lower 16 of 20 bits) of the active memory address used by the flight code at the beginning of a packet. This value will vary from packet to packet. (See memory usage Table 4-22 for details.)

DS-208 ICP Packet Start Address Segment -
This parameter indicates the offset portion (upper 4 of 20 bits) of the active memory address used by the flight code at the beginning of a packet. This value will vary from packet to packet. (See memory usage Table 4-22 for details.)

DS-209 ICP Address Changed Indicator -
This parameter is an internal instrument flight code only parameter and should always indicate zero.

DS-210 ICP Minimum Execution Time (CDD-16) -
This parameter shows the shortest execution time among the 660 ICP software polling loops per packet. Nominally, this is expected to be in the range of 2-3 milliseconds. The converted value is computed using DRL-64 (Reference 8) algorithm 4 Linear Coefficients listed in Table 8-3 Sub-type N.

DS-211 ICP Minimum Sample Number -
This parameter indicates which sample during the packet when the shortest ICP execution time occurred. The typical range is 0..659.

DS-212 ICP Maximum Execution Time (CDD-17) -

This parameter shows the longest execution time among the 660 ICP software polling loops per packet. Nominally, this is expected to be in the range of 5-6 milliseconds. The converted value is computed using DRL-64 (Reference 8) algorithm 4 Linear Coefficients listed in Table 8-3 Sub-type N.

DS-213 ICP Maximum Sample Number -
This parameter indicates which sample during the packet when the longest ICP execution time occurred. The typical range is 0..659.

DS-214 ICP RAM Code Checksum -
This parameter indicates the internally computed checksum value for the ICP RAM (Random Access Memory) code. This value is updated whenever new Flight Code Memory Patches are loaded using the ICP_Memory_Load, ICP_Unique_Data_Load, or ICP_Sequence_Table_Load long commands. Updates to the instrument memory are expected after every power-on or reset. See section on Flight Code Memory Patches for more details.

DS-215 ICP ROM Code Checksum -
This parameter indicates the internally computed checksum value for the ICP ROM (Read Only Memory) code. This value is based on the preprogrammed flight code and is not expected to change. It will however, be different for each instrument.

DS-216 SPS 1 State -
This parameter indicates if the sun was detected on Solar Presence Sensor 1 as of the last sample during the current packet. See Table 4-19, note 130. A sun presence state assumes this sensor was enabled by the Set_SPS1_Response command. A sun detected signal is used as an input by the solar avoidance algorithm for determining if the instrument should be safed due to the sun possibly coming into the FOV of the bolometer detectors. (See the section Algorithm 6 - Solar Presence Sensor: on Solar Avoidance for further details.)

DS-217 SPS 2 State -
This parameter indicates if the sun was detected on Solar Presence Sensor 1 as of the last sample during the current packet. See Table 4-19, note 130. A sun presence state assumes this sensor was enabled by the Set_SPS2_Response command. A sun detected signal is used as an input by the solar avoidance algorithm for determining if the instrument should be safed due to the sun possibly coming into the FOV of the bolometer detectors. (See the Algorithm 6 - Solar Presence Sensor: on Solar Avoidance for further details.)

DS-218 SPS 1 Response -
This parameter indicates whether the instrument will execute a SAFE mode sequence in response to a solar warning by the solar presence sensors. See Table 4-19, note 131. (See the Algorithm 6 - Solar Presence Sensor: on Solar Avoidance for further details.) This parameter reflects the SET_SPS1_RESPONSE command. Default = ENABLED????

DS-219 SPS 2 Response -
This parameter indicates whether the instrument will execute a SAFE mode sequence in response to a solar warning by the solar presence sensors. See Table 4-19, note 131. (See the Algorithm 6 - Solar Presence Sensor: on Solar Avoidance for further details.) This parameter reflects the SET_SPS2_RESPONSE command. Default = ENABLED????

DS-220 Solar Warning -

This parameter indicates that the instrument's solar presence sensors have confirmed the sun is within the FOV of the sensors and that potential damage to the radiometers may result. See Table 4-19, note 133. Should a warning occur, the instrument will automatically command the instrument to the safe mode using the safe mode internal sequence.

DS-221 Scan Time-out Response -
This parameter indicates the response the instrument will take if the elevation scan counter reaches 0. See Table 4-19, note 134. If the response is enabled and the counter reaches 0, the instrument will execute the Special_Short_Earth_Scan mode sequence which causes the elevation gimbal to begin a short-earth scan profile. The parameter is controlled with the SET_SCAN_TIMEOUT_RESPONSE command.

DS-222 Scan Time-out Counting -
This parameter indicates whether the solar avoidance scan time-out counting condition is active. See Table 4-19, note 135. Scan time-out counting will be active when the instrument is performing an azimuth biaxial scan, an elevation normal-earth scan, and the Scan Time-out Response is enabled.

DS-223 Scan Time-out Occurred -
This parameter indicates whether a solar avoidance scan time-out condition has occurred during this packet. See Table 4-19, note 142. A time-out occurs when the scan time-out counter has reached zero. Upon reaching zero, the instrument will be commanded to perform a special short-earth scan internal mode sequence. (See Algorithm 6 - Solar Presence Sensor: on Solar Avoidance for further details.)

DS-224 Solar Warning Event Sample Number -
This parameter indicates the sample number when a solar warning occurred and the instrument was commanded to a safing condition, should this have occurred during the current packet.

DS-225 Solar Warning Event Scan Period -
This parameter indicates the packet number when a solar warning occurred and the instrument was commanded to a safing condition, should this have occurred during the current packet. (See the Algorithm 6 - Solar Presence Sensor: on Solar Avoidance for further details.)

DS-226 Scan Time-out Scan Period -
This parameter indicates the packet number when a solar avoidance time-out condition last occurred and the instrument was commanded to perform a special short-earth scan internal mode sequence. (See Algorithm 6 - Solar Presence Sensor: on Solar Avoidance for further details.)

DS-227 SPS 1 Narrow FOV Signal (RPC - 9)-
This parameter indicates a count value from the solar presence sensor narrow FOV circuitry. This parameter is a copy of the last measurement collected in the analog engineering data. Values indicate light (typically solar light) is being detected within the narrow FOV window, and is the input to the solar warning evaluation algorithms.

DS-228 SPS 1 Wide FOV Signal (RPC - 10)-
This parameter indicates a count value from the solar presence sensor wide FOV circuitry. This parameter is a copy of the last measurement collected in the analog engineering data. Values indicate light (typically solar light) is being detected within the wide FOV window, and is the input to the solar warning evaluation algorithms. This signal is also used to determine the threshold level

for the narrow FOV. (See Algorithm 6 - Solar Presence Sensor: on Solar Avoidance for further details.)

DS-229 SPS 1 Threshold Noise -
This parameter indicates the count value used by the solar detection algorithm to determine a valid solar sensor detection by the wide FOV signal. The default value is 500 counts. This parameter reflects the SET_SPS1_THRESHOLD_NOISE command. (See Algorithm 6 - Solar Presence Sensor: on Solar Avoidance for further details.)

DS-230 SPS 1 Threshold Scale Numerator -
This parameter indicates a scaling coefficient used in the solar detection algorithm (narrow FOV to wide FOV ratio). The default value is 32. This parameter reflects the SET_SPS1_THRESHOLD_NUMERATOR command. (See Algorithm 6 - Solar Presence Sensor: on Solar Avoidance for further details.

DS-231 SPS 1 Solar Detection State -
This parameter indicates the results of the solar detection algorithm for this packet. See Table XXX, note 132. This status will indicate the sun is present only when the number of valid wide FOV detections exceeds the detection count threshold. This detection algorithm operates continually. (See Algorithm 6 - Solar Presence Sensor:tion on Solar Avoidance for further details.)

DS-232 SPS 1 Solar Detection Count -
This parameter indicates the number of detections the solar detection algorithm has registered in the packet. This detection counting algorithm operates continually. Note: Due to the incrementing/decrementing nature of this algorithm, values will most likely be seen here only if the Sun is begin sensed during the later samples in a packet. (See Algorithm 6 - Solar Presence Sensor: on Solar Avoidance for further details.)

DS-233 SPS 1 Solar Detection Count Threshold -
This parameter indicates the number of detected solar samples needed to signify that a confirmed solar detection condition. (See Algorithm 6 - Solar Presence Sensor: on Solar Avoidance for further details.) The default value is 5 samples. This parameter reflects the SET_SPS1_THRESHOLD_COUNT command.

DS-234 SPS 1 Solar Detection Max Count -
This parameter indicates the maximum number of solar detections that was registered in the current scan, regardless of the current SPS 1 Solar Detection Count value. Since this detection operates continuously, this parameter is a useful diagnostic parameter. (See Algorithm 6 - Solar Presence Sensor: on Solar Avoidance for further details.)

DS-235 SPS 2 Narrow FOV Signal (RPC - 11)-
This parameter indicates a count value from the solar presence sensor narrow FOV circuitry. This parameter is a copy of the last measurement collected in the analog engineering data. Values indicate light (typically solar light) is being detected within the narrow FOV window, and is the input to the solar warning evaluation algorithms.

DS-236 SPS 2 Wide FOV Signal (RPC - 12)-
This parameter indicates a count value from the solar presence sensor wide FOV circuitry. This parameter is a copy of the last measurement collected in the analog engineering data. Values indicate light (typically solar light) is being detected within the wide FOV window, and is the input

to the solar warning evaluation algorithms. This signal is also used to determine the threshold level for the narrow FOV. (See Algorithm 6 - Solar Presence Sensor: on Solar Avoidance for further details.)

DS-237 SPS 2 Threshold Noise -
This parameter indicates the count value used by the solar detection algorithm to determine a valid solar sensor detection by the wide FOV signal. The default value is 500 counts. This parameter reflects the SET_SPS2_THRESHOLD_NOISE command. (See Algorithm 6 - Solar Presence Sensor: on Solar Avoidance for further details.)

DS-238 SPS 2 Threshold Scale Numerator -
This parameter indicates a scaling coefficient used in the solar detection algorithm (narrow FOV to wide FOV ratio). The default value is 32. This parameter reflects the SET_SPS2_THRESHOLD_NUMERATOR command. (See Algorithm 6 - Solar Presence Sensor: on Solar Avoidance for further details.

DS-239 SPS 2 Solar Detection State -
This parameter indicates the results of the solar detection algorithm for this packet. See Table XXX, note 132. This status will indicate the sun is present only when the number of valid wide FOV detections exceeds the detection count threshold. This detection algorithm operates continually. (See Algorithm 6 - Solar Presence Sensor: on Solar Avoidance for further details.)

DS-240 SPS 2 Solar Detection Count -
This parameter indicates the number of detections the solar detection algorithm has registered in the packet. This detection counting algorithm operates continually. Note: Due to the incrementing/decrementing nature of this algorithm, values will most likely be seen here only if the Sun is begin sensed during the later samples in a packet. (See Algorithm 6 - Solar Presence Sensor: on Solar Avoidance for further details.)

DS-241 SPS 2 Solar Detection Count Threshold -
This parameter indicates the number of detected solar samples needed to signify that a confirmed solar detection condition. (See section on Solar Avoidance for further details.) The default value is 5 samples. This parameter reflects the SET_SPS2_THRESHOLD_COUNT command.

DS-242 SPS 2 Solar Detection Max Count -
This parameter indicates the maximum number of solar detections that was registered in the current scan, regardless of the current SPS 2 Solar Detection Count value. Since this detection operates continuously, this parameter is a useful diagnostic parameter. (See Algorithm 6 - Solar Presence Sensor: on Solar Avoidance for further details.)

DS-243 Solar Avoidance Initial Scan Count -
This parameter indicates the starting scan count to be used for scan time-out counting. The internal default is 10 packets. This will reflect the last commanded value loaded with the Set_Scan_Timeout_Count command. The value is determined based on orbital planning aids. (See the Algorithm 6 - Solar Presence Sensor: on Solar Avoidance for further details.)

DS-244 Solar Avoidance Current Scan Count -
This decrementing counter reflects the number of 6.6 second packets remaining before the instrument executes a SPECIAL_SHORT_EARTH_SCAN mode sequence. The initial count value is set using the SET_SCAN_TIMEOUT_COUNT command. (See the Algorithm 6 - Solar

Presence Sensor: on Solar Avoidance for further details.)

Table 4-19. Digital Status Enumerations (Sheet 1 of 3)

Note	Digital Status Representations	Note	Digital Status Representations
100	0 = Off 1 = On	101	0 = Bridge_Balance_Off 1 = Bridge_Balance_Maintenance 2 = Bridge_Balance_Reset
102	0 = DAC_Value_Unchanged 1 = DAC_Value_Changed	103	0 = Off 1 = Level_1 2 = Level_2 3 = Level_3
104	0 = Cover_Stop 1 = Cover_Open 2 = Cover_Close 4 = Fixed_Step_To_Open 5 = Fixed_Step_To_Close	105	0 = Cover_Stopped 1 = Cover_Opening 2 = Cover_Closing 4 = Cover_Stepping_Forward 5 = Cover_Stepping_Reverse 15 = Cover_Started_Moving
106	0 = Cover_Not_At_Open_Or_Close 1 = Cover_At_Open_Position 2 = Cover_At_Closed_Position 4 = Potentially_Failed_Position_Sensor	107	0 = Cover_Sensor_1 1 = Cover_Sensor_2
108	0 = Stow 1 = Normal_Earth_Scan 2 = Short_Earth_Scan 3 = MAM_Scan 4 = Nadir_Scan 5 = Noise_Scan_1 6 = Noise_Scan_2 7= Stow_Minus_45_Dwell 8 = Slam_Against_Stop 9 = ICS_Scan 10 = WFBB_Scan 11 = Nadir_Dwell_Scan 12 = Nadir_Plus_80_Dwell 13 = Nadir_Minus_80_Dwell 14 = MAM_Uniformity_Scan 15 = Step_Response_Scan	109	0 = Normal_Scan_Operation 1 = Initialization_In_Progess 2 = At_Initialized_Position 3 = Scan_Abort_In_Progress 4 = Elevation_At_Aborted_Position
110	0 = Low 1 = High	111	0 = Goto_Position_Crosstrack 1 = Goto_Position_A 2 = Goto_Position_B 3 = Goto_Position_Solar_Cal 4 = Goto_Position_Caged 5 = Goto_Position_Spare_1 6 = Goto_Position_Spare_2 7 = Goto_Position_Spare_3 8 = Scan_A_B_Asynchronously 9 = Scan_A_B_Synchronously 10 = Stop_Azimuth 15 = Initialized
112	0 = Stopped 1 = Moving	113	0 = Forward 1 = Backward

Table 4-19. Digital Status Enumerations (Sheet 2 of 3)

Note	Digital Status Representations	Note	Digital Status Representations
114	0 = At_Goto_Position 1 = At_Stopped_Position 2 = At_Initial_Position 3 = At_Scan_Position 4 = In_Motion	115	0 = Disabled 1 = Enabled
116	0 = Stop 1 = Cage 2 = Apply 3 = Release 4 = Fixed_Step_To_Cage 5 = Fixed_Step_To_Apply	117	0 = Stopped 1 = Caging 2 = Applying 3 = Releasing 4 = Forward_Stepping 5 = Reverse_Stepping 15 = Started_Moving
118	0 = Not_At_Release_Applied_Or_Caged 1 = At_Caged_Position 2 = At_Applied_Position 3 = At_Released_Position 4 = Potentially_Failed_Position_Sensor	119	0 = Normal_Science_Data 1 = Calibration_Data 2 = Memory_Dump_Data 3 = Gimbal_Data 4 = Execution_Time_Data 5 = No_Archive_Data 6 = Fixed_Pattern_Data
120	0 = FTM 1 = PFM (TRMM) 2 = FM1 (EOS-AM FORE) 3 = FM2 (EOS-AM AFT) 4 = FM3 (EOS-PM FORE) 5 = FM4 (EOS-PM AFT) 6 = FM5 (Spare)	121	0 = SpaceCraft_Timing 1 = Instrument_Timing
122	0 = Safe_Mode 1 = Standby_Mode 2 = Crosstrack_Mode 3 = Biaxial_Mode 4 = Solar_Calibration_Mode 5 = Diagnostic_Config_Mode 6 = Internal_Calibration_Mode 7 = Special_Short_Scan_Mode 8 = Contamination_Safe_Mode 9 = Hold_Mode 10 = Abbrev_Internal_Cal_Mode	123	0 = Command 1 = Safehold 2 = Solar_Avoidance 3 = Scan_Timeout
124	0 = Executing_Sequence 1 = Waiting_For_Next_Scan 2 = Waiting_For_Azimuth 3 = Sequence_Complete	125	0 = Normal_Operation 1 = Spacecraft_Safehold
126	0 = Response_Disabled 1 = Response_Enabled	127	0 = Normal_Reset (Not By Timeout) 1 = Watchdog_Reset (By Timeout)
128	0 = Enabled (Timer Disarmed) 1 = Disabled (Timer Armed)	129	0 = On 1 = Off
130	0 = Sun_Not_Present 1 = Sun_Present	131	0 = SPS_Response_Disabled 1 = SPS_Response_Enabled
132	0 = Sun_Not_Detected 1 = Sun_Detected	133	0 = No_Solar_Warning 1 = Solar_Warning

Table 4-19. Digital Status Enumerations (Sheet 3 of 3)

Note	Digital Status Representations	Note	Digital Status Representations
134	0 = Timeout_Response_Disabled 1 = Timeout_Response_Enabled	135	0 = Scan_Timeout_Not_Active 1 = Scan_Timeout_Active
136	0 = Not_Stalled 1 = Stalled	137	0 = Flag_Not_Set 1 = Flag_Set
138	0 = DMA_Communication_Ok 1 = DMA_Transmit_Timed_Out 2 = DMA_Receive_Timed_Out 3 = Sample_Numbers_Not_Sync	139	0 = Cmd_Accepted 1 = Cmd_Not_Used 2 = Cmd_Index_Out_Of_Range 3 = Cmd_Parameter_Out_Of_Range 4 = Cmd_Not_A_Valid_Short_Command 5 = Cmd_Not_A_Valid_Long_Command 6 = Cmd_Had_A_Incorrect_Checksum 7 = Cmd_Exceeded_Mode_Index 8 = Cmd_UnAccepted_In_Current_Mode 9 = Cmd_UnAccepted_During_Seq_Exec 10 = Cant_Use_Brake_While_Az_Moving 11 = Cant_Cage_Az_In_Current_Pos 12 = Cant_Move_Az_Brake_Unreleased 13 = Req_Mode_Invalid_In_Curr_Mode 14 = Pos_A_Must_Be_Less_Than_Pos_B
140	0 = Spacecraft 1 = Internal_Sequence	141	0 = No_Error 1 = Unexpected_Interrupt 2 = Illegal_Int_Seq_Control_Value 3 = Process_Short_Cmd_Illegal_Cmd 4 = Process_Long_Cmd_Illegal_Cmd 5 = Checksum_Illegal_Command 6 = Received_1553_Message_With_Err 7 = Incorrect_Initial_DMA_Syncs 8 = PackData_Illegal_Data_Indictr 9 = Int_Seq_Index_Limit_Exceeded 10 = Failed_At_Least_One_DAA_Comm 11 = Illegal_HK_Destination_Size 12 = Spurious_DAP_Sample_Clk_Intrpt 13 = Spurious_ICP_Sample_Clk_Intrpt 20 = Potential_Failed_Brake_Sensor 21 = Potential_Failed_Cover_Sensor 22 = MainCover_Allowed_Lag_Exceeded 23 = Pckt_Transfer_Lockup_Detected 24 = DAA_ICA_Sample_Nums_Mismatch 25 = DAA_Reset_via_Contin_Comm_Fail 63 = Undefined_Instrument_Cmd_Err
142	0 = No_Scan_Timeout 1 = Scan_Timeout_Occurred	143	0 = Response_Disabled 1 = Response_Enabled
144	0 = Signal_Not_Received 1 = Signal_Received	145	0 = Signal_Received 1 = Signal_Not_Received
146	0 = Bus_A_Selected 1 = Bus_B_Selected	147	0 = No_Time_Freq_Interupt 1 = Time_Freq_Interupt_Occurred

Table 4-20. CERES Instrument Command Enummerations (Sheet 1 of 7)

Line Item No.	Main Command Description	Main Value (Decimal/ (Hex))	Parameter Index Values
[ICP COMMANDS]			
1.	No_Command_ICP	0	N/A
2.	Command_Azimuth_Goto_Position	256* (100)	0 = Command_Azimuth_Goto_Crosstrack 1 = Command_Azimuth_Goto_Position_A 2 = Command_Azimuth_Goto_Position_B 3 = Command_Azimuth_Goto_SolarCal 4 = Command_Azimuth_Goto_Cage 5 = Command_Azimuth_Goto_Spare_1 6 = Command_Azimuth_Goto_Contam 7 = Command_Azimuth_Goto_Spare_3 8 = Command_Azimuth_Scan_AB_Async 9 = Command_Azimuth_Scan_AB_Sync 10 = Command_Azimuth_To_Stop
3.	Set_Azimuth_Fixed_Crosstrack	512 (200)	0..65535 = Fixed Raw Azimuth Position
4.	Set_Azimuth_Fixed_Position_A	513 (201)	0..65535 = Fixed Raw Azimuth Position
5.	Set_Azimuth_Fixed_Position_B	514 (202)	0..65535 = Fixed Raw Azimuth Position
6.	Set_Azimuth_Fixed_SolarCal	515 (203)	0..65535 = Fixed Raw Azimuth Position
7.	Set_Azimuth_Fixed_Caged	516 (204)	0..65535 = Fixed Raw Azimuth Position
8.	Set_Azimuth_Fixed_Spare_1	517 (205)	0..65535 = Fixed Raw Azimuth Position
9.	Set_Azimuth_Fixed_Spare_2	518 (206)	0..65535 = Fixed Raw Azimuth Position
10.	Set_Azimuth_Fixed_Spare_3	519 (207)	0..65535 = Fixed Raw Azimuth Position
11.	Set_Azimuth_Rate_Goto_Rate	768 (300)	1371 = Fixed Raw Azimuth Rate (Typ.)
12.	Set_Azimuth_Rate_Async_Rate	769 (301)	1096 = Fixed Raw Azimuth Rate (Typ.)
13.	Set_Azimuth_Rate_Sync_Rate	770 (302)	913 = Fixed Raw Azimuth Rate (Typ.)
14.	Command_Brake	1024* (400)	0 = Command_Brake_Stop 1 = Command_Brake_Cage 2 = Command_Brake_Apply 3 = Command_Brake_Release
15.	Step_Brake_To_Caged	1280 (500)	0..1000 (Typ.)
16.	Step_Brake_To_Applied	1536 (600)	0..1000 (Typ.)

Table 4-20. CERES Instrument Command Enummerations (Sheet 2 of 7)

Line Item No.	Main Command Description	Main Value (Decimal/ (Hex))	Parameter Index Values
17.	Set_Instrument_Mode	4096* (1000)	0 = Set_Mode_Safe 1 = Set_Mode_Standby 2 = Set_Mode_Crosstrack 3 = Set_Mode_Biaxial 4 = Set_Mode_Solar_Cal 5 = Set_Mode_Diagnostic 6 = Set_Mode_Internal_Cal 7 = Set_Mode_Spec_Short_Scan 8 = Set_Mode_Contam_Safe 9 = Set_Mode_Hold 10 = Set_Mode_Abbrev_Int_Cal 11 = Set_Mode_Int_Seq_11 12 = Set_Mode_Int_Seq_12 13 = Set_Mode_Int_Seq_13 14 = Set_Mode_Int_Seq_14 15 = Set_Mode_Int_Seq_15
18.	Set_Safehold_Response_A (TRMM Command)	4352* (1100)	0 = Set_Safehold_Response_A_Disabled 1 = Set_Safehold_Response_A_Enabled
19.	Set_Safehold_Response_B (TRMM Command)	4353* (1101)	0 = Set_Safehold_Response_B_Disabled 1 = Set_Safehold_Response_B_Enabled
20.	Set_SPS1_Response	4608* (1200)	0 = Set_SPS1_Response_Disabled 1 = Set_SPS1_Response_Enabled
21.	Set_SPS2_Response	4609* (1201)	0 = Set_SPS2_Response_Disabled 1 = Set_SPS2_Response_Enabled
22.	Set_SPS1_Threshold_Noise	4864 (1300)	0..4095 (Typ.)
23.	Set_SPS2_Threshold_Noise	4865 (1301)	0..4095 (Typ.)
24.	Set_SPS1_Threshold_Numerator	5120 (1400)	0..63 (Typ.)
25.	Set_SPS2_Threshold_Numerator	5121 (1401)	0..63 (Typ.)
26.	Set_SPS1_Threshold_Count	5376 (1500)	0..55 (Typ.)
27.	Set_SPS2_Threshold_Count	5377 (1501)	0..55 (Typ.)
28.	Set_Scan_Timeout_Response	5632* (1600)	0 = Set_Scan_Timeout_Response_Disabled 1 = Set_Scan_Timeout_Response_Enabled
29.	Set_Scan_Timeout_Count	5888 (1700)	0..1000 (Typ.)
30.	Set_Quicklook_Flag	6400* (1900)	0 = Set_Quicklook_Flag_Normal 1 = Set_Quicklook_Flag_Quicklook

Table 4-20. CERES Instrument Command Enummerations (Sheet 3 of 7)

Line Item No.	Main Command Description	Main Value (Decimal/ (Hex))	Parameter Index Values
31.	Select_Time_Mark_Frequency_Bus (EOS-AM Command)	6656* (1A00)	0 = Bus A 1 = Bus B
32.	Set_Time_Mark_Frequency_Response (EOS-AM Command)	6912* (1B00)	0 = Response_Disabled 1 = Response_Enabled
33.	Set_IMOK_Signal_Response (EOS-AM Command)	7168* (1C00)	0 = Response_Disabled 1 = Response_Enabled
34.	Set_Watchdog_Timer_ICP	7680* (1E00)	0 = Set_Watchdog_Timer_ICP_Disarm 1 = Set_Watchdog_Timer_ICP_Arm
35.	Set_PROM_Power_ICP	7936* (1F00)	0 = Set_PROM_Power_ICP_On 1 = Set_PROM_Power_ICP_Off
36.	Set_Mem_Dump_Start_Offset_ICP	8192 (2000)	0..65535
37.	Set_Mem_Dump_Start_Segment_ICP	8448 (2100)	0..65535
38.	Set_Mem_Dump_End_Offset_ICP	8704 (2200)	0..65535
39.	Set_Mem_Dump_End_Segment_ICP	8960 (2300)	0..65535
40.	Set_Azimuth_Encoder_LED	9728* (2600)	0 = Set_Azimuth_Encoder_LED_Low 1 = Set_Azimuth_Encoder_LED_High
41.	Set_Azimuth_Offset_Correction	9984 (2700)	0..65535
42.	Set_Azimuth_Stall_Error_Thres	10240 (2800)	0..65535
43.	Set_Azimuth_Stall_Count_Thres	10496 (2900)	0..659 (References number of samples)
44.	Set_Packet_Data_Type	12288* (3000)	0 = Set_Packet_Data_Type_Normal 1 = Set_Packet_Data_Type_Cal 2 = Set_Packet_Data_Type_Mem 3 = Set_Packet_Data_Type_Gimbal 4 = Set_Packet_Data_Type_Execution 5 = Set_Packet_Data_Type_Noarchive 6 = Set_Packet_Data_Type_Fixed
45.	Low_Rate_Science_Transfer_Enable (EOS-AM Command)	12544* (3100)	0 = Transfer_Enabled 1 = Transfer_Disabled
[DAP COMMANDS]			
46.	No_Command_DAP	16384 (4000)	N/A

Table 4-20. CERES Instrument Command Enummerations (Sheet 4 of 7)

Line Item No.	Main Command Description	Main Value (Decimal/ (Hex))	Parameter Index Values
47.	Set_Scan_Mode	16640* (4100)	0 = Set_Scan_Mode_Stow 1 = Set_Scan_Mode_Normal_Earth 2 = Set_Scan_Mode_Short_Earth 3 = Set_Scan_Mode_MAM_Scan 4 = Set_Scan_Mode_Nadir_Scan 5 = Set_Scan_Mode_Noise_Test_1 6 = Set_Scan_Mode_Noise_Test_2 7 = Set_Scan_Mode_Cal_Mode_5 8 = Set_Scan_Mode_Cal_Mode_6A 9 = Set_Scan_Mode_Cal_Mode_6B 10 = Set_Scan_Mode_Cal_Mode_7 11 = Set_Scan_Mode_Cal_Mode_8A 12 = Set_Scan_Mode_Cal_Mode_8B 13 = Set_Scan_Mode_Cal_Mode_11 14 = Set_Scan_Mode_Cal_Mode_12 15 = Set_Scan_Mode_Cal_Mode_14
48.	Command_Cover_Main	16896* (4200)	0 = Command_Cover_Main_Stop 1 = Command_Cover_Main_Open 2 = Command_Cover_Main_Close 3 = Command_Cover_Main_Unused
49.	Command_Cover_MAM	16897* (4201)	0 = Command_Cover_MAM_Stop 1 = Command_Cover_MAM_Open 2 = Command_Cover_MAM_Close 3 = Command_Cover_MAM_Unused
50.	Set_SWICS_Intensity	17152* (4300)	0 = Set_SWICS_Intensity_Off 1 = Set_SWICS_Intensity_Level_1 2 = Set_SWICS_Intensity_Level_2 3 = Set_SWICS_Intensity_Level_3
51.	Set_Blackbody_Temp_Setpoint	17408 (4400)	0..4095
52.	Set_Blackbody_Temp_Control	17664* (4500)	0 = Set_Blackbody_Temp_Control_Off 1 = Set_Blackbody_Temp_Control_On
53.	Set_Tot_Brid_Bal_Coarse_DAC_Val	17920 (4600)	0..4095
54.	Set_SW_Brid_Bal_Coarse_DAC_Val	17921 (4601)	0..4095
55.	Set_WN_Brid_Bal_Coarse_DAC_Val	17922 (4602)	0..4095
56.	Set_Tot_Brid_Bal_Fine_DAC_Val	18176 (4700)	0..4095
57.	Set_SW_Brid_Bal_Fine_DAC_Val	18177 (4701)	0..4095

Table 4-20. CERES Instrument Command Enummerations (Sheet 5 of 7)

Line Item No.	Main Command Description	Main Value (Decimal/ (Hex))	Parameter Index Values
58.	Set_WN_Brid_Bal_Fine_DAC_Val	18178 (4702)	0..4095
59.	Set_Tot_Brid_Bal_Control_Mode	18432* (4800)	0 = Set_Tot_Brid_Bal_Control_Mode_Off 1 = Set_Tot_Brid_Bal_Control_Mode_On
60.	Set_SW_Brid_Bal_Control_Mode	18433* (4801)	0 = Set_SW_Brid_Bal_Control_Mode_Off 1 = Set_SW_Brid_Bal_Control_Mode_On
61.	Set_WN_Brid_Bal_Control_Mode	18434* (4802)	0 = Set_WN_Brid_Bal_Control_Mode_Off 1 = Set_WN_Brid_Bal_Control_Mode_On
62.	Set_Tot_Sensor_Temp_Setpoint	18688 (4900)	0..4095
63.	Set_SW_Sensor_Temp_Setpoint	18689 (4901)	0..4095
64.	Set_WN_Sensor_Temp_Setpoint	18690 (4902)	0..4095
65.	Set_Tot_Sensor_Temp_Control	18944* (4A00)	0 = Set_Tot_Sensor_Temp_Control_Off 1 = Set_Tot_Sensor_Temp_Control_On
66.	Set_SW_Sensor_Temp_Control	18945* (4A01)	0 = Set_SW_Sensor_Temp_Control_Off 1 = Set_SW_Sensor_Temp_Control_On
67.	Set_WN_Sensor_Temp_Control	18946* (4A02)	0 = Set_WN_Sensor_Temp_Control_Off 1 = Set_WN_Sensor_Temp_Control_On
68.	Set_Tot_Sensor_Temp_Coef_A0	19200 (4B00)	-32768..32767
69.	Set_SW_Sensor_Temp_Coef_A0	19201 (4B01)	-32768..32767
70.	Set_WN_Sensor_Temp_Coef_A0	19202 (4B02)	-32768..32767
71.	Set_Tot_Sensor_Temp_Coef_A1	19456 (4C00)	-32768..32767
72.	Set_SW_Sensor_Temp_Coef_A1	19457 (4C01)	-32768..32767
73.	Set_WN_Sensor_Temp_Coef_A1	19458 (RC02)	-32768..32767
74.	Set_Tot_Sensor_Temp_Coef_B1	19712 (4D00)	-32768..32767
75.	Set_SW_Sensor_Temp_Coef_B1	19713 (4D01)	-32768..32767
76.	Set_WN_Sensor_Temp_Coef_B1	19714 (4D02)	-32768..32767
77.	Set_Tot_Sensor_Temp_Coef_D0	19968 (4E00)	-32768..32767

Table 4-20. CERES Instrument Command Enummerations (Sheet 6 of 7)

Line Item No.	Main Command Description	Main Value (Decimal/ (Hex))	Parameter Index Values
78.	Set_SW_Sensor_Temp_Coef_D0	19969 (4E01)	-32768..32767
79.	Set_WN_Sensor_Temp_Coef_D0	19970 (4E02)	-32768..32767
80.	Set_Main_Cover_Active_Pos_Sensor	20480* (5000)	0 = Set_Main_Cover_Active_Pos_Sensor_1 1 = Set_Main_Cover_Active_Pos_Sensor_2
81.	Step_Main_Cover_To_Open	20736 (5100)	0..65535
82.	Step_MAM_Cover_To_Open	20737 (5101)	0..65535
83.	Step_Main_Cover_To_Closed	20992 (5200)	0..65535
84.	Step_MAM_Cover_To_Closed	20993 (5201)	0..65535
85.	Set_Main_Cover_Sensor_1_Lag_Error	21248 (5300)	0..255
86.	Set_Main_Cover_Sensor_2_Lag_Error	21249 (5301)	0..255
87.	Set_Submux_Control	23040* (5A00)	0 = Set_Submux_Control_Table 1 = Set_Submux_Control_Fixed_Channel
88.	Set_Submux_Fixed_Channel	23296 (5B00)	0..255
89.	Set_Elevation_Stow_Pos	23552 (5C00)	0..65535
90.	Set_Watchdog_Timer_DAP	24064* (5E00)	0 = Set_Watchdog_Timer_DAP_Disarm 1 = Set_Watchdog_Timer_DAP_Arm
91.	Set_PROM_Power_DAP	24320* (5F00)	0 = Set_PROM_Power_DAP_On 1 = Set_PROM_Power_DAP_Off
92.	Set_Mem_Dump_Start_Offset_DAP	24576 (6000)	0..65535
93.	Set_Mem_Dump_Start_Segment_DAP	24832 (6100)	0..65535
94.	Set_Mem_Dump_End_Offset_DAP	25088 (6200)	0..65535
95.	Set_Mem_Dump_End_Segment_DAP	25344 (6300)	0..65535
96.	Set_Elevation_Encoder_LED	26112* (6600)	0 = Set_Elevation_Encoder_LED_Low 1 = Set_Elevation_Encoder_LED_High
97.	Set_Elevation_Offset_Correction	26368 (6700)	0..65535

Table 4-20. CERES Instrument Command Enummerations (Sheet 7 of 7)

Line Item No.	Main Command Description	Main Value (Decimal/ (Hex))	Parameter Index Values
98.	Set_Elevation_Stall_Error_Thres	26624 (6800)	0..65535
99.	Set_Elevation_Stall_Count_Thres	26880 (6900)	0..659 (References no. of samples)
	[LONG COMMANDS]		
100.	ICP_Memory_Load	37120 (9100)	See Command ID Table XXX for Format
101.	ICP_Sequence_Table_Load	41472 (A200)	See Command ID Table XXX for Format
102.	ICP_Unique_Data_Load	42240 (A500)	See Command ID Table XXX for Format
103.	DAP_Memory_Load	53504 (D100)	See Command ID Table YYY for Format
104.	DAP_Unique_Data_Load	58624 (E500)	See Command ID Table YYY for Format
105.	DAP_Scan_Table_Load	62208 (F300)	See Command ID Table YYY for Format
Note: Main Values with an (*) indicates that a Parameter Value needs to be checked to identify the complete enumerated description of the corresponding specific Main Command.			

COMMAND DESCRIPTIONS (Referenced by Line Item Number)

The following data description reference the commands that are available for operating the CERES instrument. Commands are used by the on-board microprocessors to perform specific activities.

Most of the commands listed below are available for the CERES instrument on the TRMM spacecraft. The instruments on the EOS-AM picks up some additional commands that involve the spacecraft interface. (Commands involving the TRMM interface are retained but are ignored.)

The commands listed below are typically categorized into either short or long commands. Short commands typically execute an single activity based on the coded instructions associated with such commands. Example activities can include setting an algorithm variable, executing a specific mechanical motion, or initiating an internal mode sequence. Internal mode sequences can be thought of as macros consisting of one or more short commands. The acceptance or rejection of short commands is based on an internal look-up (mask) table. See Table 4-24. The acceptance and execution of internal sequence commands is based on an internal sequence look-up (mask) table. See Table 4-23. Note: Except for the SAFE mode sequence, NO sequence will be executed if an internal sequence is currently be executed.

There are also six (6) commands that are referred to as long commands. These commands are typically a means of modifying the "large" segments of the flight code. Examples include Flight Code Memory Patches (to fix code bugs) or changing internal "macros".

1. No_Command_ICP - This reserved short command does nothing.

2. Command_Azimuth_Goto_Position - This short command specifies the instrument to direct the azimuth gimbal assembly to move to a predefined GOTO position specified by the parameter index value. Motion is commenced based satisfying certain safety conditions (1). The motion will slew based on the defined Normal_Slew_Rate.

3. Set_Azimuth_Fixed_Crosstrack - This short command specifies the instrument to change the internal predefined azimuth crosstrack gimbal position to a count value specified by the parameter index value.

4. Set_Azimuth_Fixed_Position_A - This short command specifies the instrument to change the internal predefined azimuth biaxal start (A) gimbal position to a count value specified by the parameter index value.

5. Set_Azimuth_Fixed_Position_B - This short command specifies the instrument to change the internal predefined azimuth biaxal end (B) gimbal position to a count value specified by the parameter index value.

6. Set_Azimuth_Fixed_SolarCal - This short command specifies the instrument to change the internal predefined azimuth solar calibration gimbal position to a count value specified by the parameter index value.

7. Set_Azimuth_Fixed_Caged - This short command specifies the instrument to change the internal predefined azimuth cage gimbal position to a count value specified by the parameter index value.

8. Set_Azimuth_Fixed_Spare_1 - This short command specifies the instrument to change the internal predefined azimuth spare (1) gimbal position to a count value specified by the parameter index value.

9. Set_Azimuth_Fixed_Spare_2 - This short command specifies the instrument to change the internal predefined azimuth spare (2) gimbal position to a count value specified by the parameter index value. This command is intended to be used in conjunction with the Contamination_Safe mode sequence.

10. Set_Azimuth_Fixed_Spare_3 - This short command specifies the instrument to change the internal predefined azimuth spare (3) gimbal position to a count value specified by the parameter index value.

11. Set_Azimuth_Rate_Goto_Rate - This short command specifies the instrument to change the internal predefined azimuth gimbal slewing rate to a count value specified by the parameter index value. The index value is derived based on the rate (in deg/sec) conversion algorithm 7. This command is used primarily for changing the slew rate for any non-biaxial slewing conditions (e.g. GOTO, Initialization, etc.).

12. Set_Azimuth_Rate_Async_Rate - This short command specifies the instrument to change the internal predefined azimuth gimbal biaxial asynchronous slewing rate to a count value specified by the parameter index value. The index value is derived based on the rate (in deg/sec) conversion algorithm 7.

13. Set_Azimuth_Rate_Sync_Rate - This short command specifies the instrument to change the internal predefined azimuth gimbal biaxial synchronous slewing rate to a count value specified by the parameter index value. The index value is derived based on the rate (in deg/sec) conversion algorithm 7.

14. Command_Brake - This short command specifies the instrument to direct the brake to an applied, caged, or released position or to stop its motion. Motion is commenced based satisfying certain safety conditions (2) and proceeds until the brake reaches its destination or stalls.

15. Step_Brake_To_Caged - This short command specifies the instrument to directs the brake to move towards the cage position the number of counts specified by the parameter index value. This command is not normally used unless there are mechanical problems (e.g. stalls) and is a means for providing controlled motion. Normally this command would be expected to be issued by ground operators during real-time contacts. Certain safety conditions also apply (2).

16. Step_Brake_To_Applied - This short command specifies the instrument to directs the brake to move towards the applied position the number of counts specified by the parameter index value. This command is not normally used unless there are mechanical problems (e.g. stalls) and is a means for providing controlled motion. Normally this command would be expected to be issued by ground operators during real-time contacts. Certain safety conditions may also apply (2).

17. Set_Instrument_Mode - This short command specifies the instrument to initiate an internal mode sequence specified by the parameter index value. Mode sequences can be thought of as command macros. A macro consists of a sequence of short commands, but can include calls to activate other sequence modes. This is the primary command for operating the instrument for most mission operations. This command will be initiated based on an internal mode lockout table (see Table 4-23).

18. Set_Safehold_Response_A - This short command specifies the instrument to
(For EOS-AM, this is the defaulted command.)

19. Set_Safehold_Response_B - This short command specifies the instrument to

(For EOS-AM, this command is not recognized, default is Set_Safehold_Response_A.)

20. Set_SPS1_Response - This short command specifies the instrument to

21. Set_SPS2_Response - This short command specifies the instrument to

22. Set_SPS1_Threshold_Noise - This short command specifies the instrument to

23. Set_SPS2_Threshold_Noise - This short command specifies the instrument to

24. Set_SPS1_Threshold_Numerator - This short command specifies the instrument to

25. Set_SPS2_Threshold_Numerator - This short command specifies the instrument to

26. Set_SPS1_Threshold_Count - This short command specifies the instrument to

27. Set_SPS2_Threshold_Count - This short command specifies the instrument to

28. Set_Scan_Timeout_Response - This short command specifies the instrument to

29. Set_Scan_Timeout_Count - This short command specifies the instrument to

30. Select_Time_Mark_Frequency_Bus (EOS-AM Only) - This short command specifies the instrument to

31. Set_Time_Mark_Frequency_Response (EOS-AM Only) - This short command specifies the instrument to

32. Set_IMOK_Signal_Response (EOS-AM Only) - This short command specifies the instrument to

33. Set_Quicklook_Flag - This short command specifies the instrument to set the quicklook status flag in the telemetry science packet based on the parameter index value. (See status parameter for further a description.)

34. Set_Watchdog_Timer_ICP - This short command specifies the instrument to arm or disarm the internal microprocessor watchdog timer. The timer should always be armed as this is an important instrument safety feature.

35. Set_PROM_Power_ICP - This short command specifies the instrument to

36. Set_Mem_Dump_Start_Offset_ICP - This short command specifies the instrument to

37. Set_Mem_Dump_Start_Segment_ICP - This short command specifies the instrument to

38. Set_Mem_Dump_End_Offset_ICP - This short command specifies the instrument to

39. Set_Mem_Dump_End_Segment_ICP - This short command specifies the instrument to

40. Set_Azimuth_Encoder_LED - This short command specifies the instrument to

41. Set_Azimuth_Offset_Correction - This short command specifies the instrument to

42. Set_Azimuth_Stall_Error_Thres - This short command specifies the instrument to

43. Set_Azimuth_Stall_Count_Thres - This short command specifies the instrument to

44. Set_Packet_Data_Type - This short command specifies the instrument to

45. Low_Rate_Science_Transfer_Enable (EOS-AM Only) - This short command specifies the instrument to

46. No_Command_DAP - This short command specifies the instrument to

47. Set_Scan_Mode - This short command specifies the instrument to

48. Command_Cover_Main - This short command specifies the instrument to

49. Command_Cover_MAM - This short command specifies the instrument to

50. Set_SWICS_Intensity - This short command specifies the instrument to

51. Set_Blackbody_Temp_Setpoint - This short command specifies the instrument to

52. Set_Blackbody_Temp_Control - This short command specifies the instrument to

53. Set_Tot_Brid_Bal_Coarse_DAC_Val - This short command specifies the instrument to

54. Set_SW_Brid_Bal_Coarse_DAC_Val - This short command specifies the instrument to

55. Set_WN_Brid_Bal_Coarse_DAC_Val - This short command specifies the instrument to

56. Set_Tot_Brid_Bal_Fine_DAC_Val - This short command specifies the instrument to

57. Set_SW_Brid_Bal_Fine_DAC_Val - This short command specifies the instrument to

58. Set_WN_Brid_Bal_Fine_DAC_Val - This short command specifies the instrument to

59. Set_Tot_Brid_Bal_Control_Mode - This short command specifies the instrument to

60. Set_SW_Brid_Bal_Control_Mode - This short command specifies the instrument to

61. Set_WN_Brid_Bal_Control_Mode - This short command specifies the instrument to

62. Set_Tot_Sensor_Temp_Setpoint - This short command specifies the instrument to

63. Set_SW_Sensor_Temp_Setpoint - This short command specifies the instrument to

64. Set_WN_Sensor_Temp_Setpoint - This short command specifies the instrument to

65. Set_Tot_Sensor_Temp_Control - This short command specifies the instrument to

66. Set_SW_Sensor_Temp_Control - This short command specifies the instrument to

67. Set_WN_Sensor_Temp_Control - This short command specifies the instrument to

68. Set_Tot_Sensor_Temp_Coef_A0 - This short command specifies the instrument to

69. Set_SW_Sensor_Temp_Coef_A0 - This short command specifies the instrument to

70. Set_WN_Sensor_Temp_Coef_A0 - This short command specifies the instrument to

71. Set_Tot_Sensor_Temp_Coef_A1 - This short command specifies the instrument to

72. Set_SW_Sensor_Temp_Coef_A1 - This short command specifies the instrument to

73. Set_WN_Sensor_Temp_Coef_A1 - This short command specifies the instrument to

74. Set_Tot_Sensor_Temp_Coef_B1 - This short command specifies the instrument to

75. Set_SW_Sensor_Temp_Coef_B1 - This short command specifies the instrument to

76. Set_WN_Sensor_Temp_Coef_B1 - This short command specifies the instrument to

77. Set_Tot_Sensor_Temp_Coef_D0 - This short command specifies the instrument to

78. Set_SW_Sensor_Temp_Coef_D0 - This short command specifies the instrument to

79. Set_WN_Sensor_Temp_Coef_D0 - This short command specifies the instrument to

80. Set_Main_Cover_Active_Pos_Sensor - This short command specifies the instrument to

81. Step_Main_Cover_To_Open - This short command specifies the instrument to

82. Step_MAM_Cover_To_Open - This short command specifies the instrument to

83. Step_Main_Cover_To_Closed - This short command specifies the instrument to

84. Step_MAM_Cover_To_Closed - This short command specifies the instrument to

85. Set_Main_Cover_Sensor_1_Lag_Error - This short command specifies the instrument to

86. Set_Main_Cover_Sensor_2_Lag_Error - This short command specifies the instrument to

87. Set_Submux_Control - This short command specifies the instrument to

88. Set_Submux_Fixed_Channel - This short command specifies the instrument to output in the analog portion of the packet, the values that will be indicated by the selected multiplexing channel. Analog parameters and their corresponding submux channel are shown in Table 4-33.

89. Set_Elevation_Stow_Pos - This short command specifies the instrument to

90. Set_Watchdog_Timer_DAP - This short command specifies the instrument to arm or disarm the internal microprocessor watchdog timer. The timer should always be armed as this is an important instrument safety feature.

91. Set_PROM_Power_DAP - This short command specifies the instrument to

92. Set_Mem_Dump_Start_Offset_DAP - This short command specifies the instrument to

93. Set_Mem_Dump_Start_Segment_DAP - This short command specifies the instrument to

94. Set_Mem_Dump_End_Offset_DAP - This short command specifies the instrument to

95. Set_Mem_Dump_End_Segment_DAP - This short command specifies the instrument to

96. Set_Elevation_Encoder_LED - This short command specifies the instrument to

97. Set_Elevation_Offset_Correction - This short command specifies the instrument to

98. Set_Elevation_Stall_Error_Thres - This short command specifies the instrument to

99. Set_Elevation_Stall_Count_Thres - This short command specifies the instrument to

100. ICP_Memory_Load - This long command specifies RAM memory load updates. The format for this command shown in Table 4-22. This command can only be accepted when the instrument is in the Diagnostic Mode (as initiated via internal sequences).

101. ICP_Sequence_Table_Load - This long command specifies changes to any of the 16 internal sequence (macro) tables. The format for this command shown in Table 4-22. This command can only be accepted when the instrument is in the Diagnostic Mode (as initiated via internal sequences).

102. ICP_Unique_Data_Load - This long command specifies changes to specific data parameters typically related to mechanical operations controlled by the ICP. The format for this command is shown in Table 4-22. This command can only be accepted when the instrument is in the Diagnostic Mode (as initiated via internal sequences).

103. DAP_Memory_Load - This long command specifies RAM memory load updates. The format for this command shown in Table 4-21. This command can only be accepted when the instrument is in the Diagnostic Mode (as initiated via internal sequences).

104. DAP_Unique_Data_Load - This long command specifies changes to specific data parameters typically related to mechanical operations controlled by the DAP. The format for this command is shown in Table 4-21. This command can only be accepted when the instrument is in the Diagnostic Mode (as initiated via internal sequences).

105. DAP_Scan_Table_Load - This long command specifies changes to any of the 16 internal elevation gimbal scanning profile tables. The format for this command shown in Table 4-21. This command can only be accepted when the instrument is in the Diagnostic Mode (as initiated via internal sequences).

(1) Azimuth motion contraintsts:
(2) Brake constraints:

Table 4-21. DAP Long command Formats

DAP Memory Load Command Format	DAP Elevation Scan Table Command Load Format	DAP Instrument Unique Data Load Command Format (TBR)
Memory Load Command	Scan Table Load Command	Instr. Unique Data Load Command
Command I.D. #	Command I.D. #	Command I.D. #
Checksum	Checksum	Checksum
Memory Load Offset Address	Scan Table Entry	Elevation Offset Correction
Memory Load Segment Address	# of Inflection Points	Main Cover Closed Position
Memory Load Length N	Checksum	Main Cover Open Position
Memory Load Value 0	Bridge Bal. Begin Space Look	Main Cover Closed Margin
Memory Load Value 1	Bridge Bal. End Space Look	Main Cover Open Margin
Memory Load Value 2	Bridge Bal. DAC Update	MAM Cover Closed Position
Memory Load Value 3	Bridge Bal. Window High	MAM Cover Open Position
Memory Load Value 4	Bridge Bal. Window Low	MAM Cover Closed Margin
Memory Load Value 5	Bridge Bal. Window Setpoint	MAM Cover Open Margin

Table 4-21. DAP Long command Formats

DAP Memory Load Command Format	DAP Elevation Scan Table Command Load Format	DAP Instrument Unique Data Load Command Format (TBR)
Memory Load Value 6	Inflection Point 0 Sample #	Instrument I.D. #
Memory Load Value 7	Inflection Point 0 Rate	Packet Data Version #
Memory Load Value 8	Inflection Point 0 Position	
Memory Load Value 9	Inflection Point 1 Sample #	
Memory Load Value 10	Inflection Point 1 Rate	
Memory Load Value 11	Inflection Point 1 Position	
⋮	⋮	
Memory Load Value N - 2	Inflection Point 31 Sample #	
Memory Load Value N - 1	Inflection Point 31 Rate	
Memory Load Value N	Inflection Point 31 Position	

Table 4-22. ICP Long Command Formats

ICP Memory Load Command Format	ICP Internal Sequence Load Command Format	ICP Instrument Unique Data Load Command Format (TBR)
Memory Load Command	Internal Sequence Load Command	Instr. Unique Data Load Command
Command I.D. #	Command I.D. #	Command I.D. #
Checksum	Checksum	Checksum
Memory Load Offset Address	0	Azimuth Offset Correction
Memory Load Segment Address	Mode Allowed Pattern	Brake Released Position
Memory Load Length N	Sample # & Sequence Control 0	Brake Applied Position
Memory Load Value 0	Scan Count 0	Brake Caged Position
Memory Load Value 1	Command 0	Brake Released Margin
Memory Load Value 2	Parameter 0	Brake Applied Margin
Memory Load Value 3	Sample # & Sequence Control 1	Brake Caged Margin
Memory Load Value 4	Scan Count 1	Instrument I.D. #
Memory Load Value 5	Command 1	Packet Data Version #
Memory Load Value 6	Parameter 1	
⋮	⋮	
Memory Load Value N - 3	Sample # & Sequence Control 29	
Memory Load Value N - 2	Scan Count 29	
Memory Load Value N - 1	Command 29	
Memory Load Value N	Parameter 29	

Table 4-23. Allowable Sequence Mode Transition Table

FROM: \ **TO:**	0 = Safe	1 = Standby	2 = Crosstrack	3 = Biaxial	4 = Solar Calibration	5 = Diagnostic	6 = Internal Calibration	7 = Special Short Scan	8 = Contamination Safe	9 = Hold	10 = Abbrev Internal Cal	11 = Unused	12 = Unused	13 = Unused	14 = Unused	15 = Unused
0 = Safe	X	X				X										
1 = Standby	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X
2 = Crosstrack	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X
3 = Biaxial	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X
4 = Solar Calibration	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X
5 = Diagnostic	X															
6 = Internal Calibration	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X
7 = Special Short Scan	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X
8 = Contamination Safe	X	X							X							
9 = Hold	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X
10 = Abbrev Internal Cal	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X
11 = Unused	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X
12 = Unused	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X
13 = Unused	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X
14 = Unused	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X
15 = Unused	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X

Table 4-24. TRMM Instrument Commands Allowed by Mode (Sheet 1 of 5)

Command Description	**All Modes**	**All Modes (except Safe)**	**All Modes (except Safe & Diagnostic)**	**Safe or Diagnostic Modes Only**	**Diagnostic Mode Only**
No_Command_ICP	X (?)				
Command_Azimuth_Goto_Position		X			
Set_Azimuth_Fixed_Crosstrack		X			

Table 4-24. TRMM Instrument Commands Allowed by Mode (Sheet 2 of 5)

Command Description	All Modes	All Modes (except Safe)	All Modes (except Safe & Diagnostic)	Safe or Diagnostic Modes Only	Diagnostic Mode Only
Set_Azimuth_Fixed_Position_A		X			
Set_Azimuth_Fixed_Position_B		X			
Set_Azimuth_Fixed_SolarCal		X			
Set_Azimuth_Fixed_Caged		X			
Set_Azimuth_Fixed_Spare_1		X			
Set_Azimuth_Fixed_Contam_Pos		X			
Set_Azimuth_Fixed_Spare_3		X			
Set_Azimuth_Rate_Goto_Rate					X
Set_Azimuth_Rate_Async_Rate					X
Set_Azimuth_Rate_Sync_Rate					X
Command_Brake		X			
Step_Brake_To_Caged		X			
Step_Brake_To_Applied		X			
Set_Instrument_Mode (PER MODE TRANSITION TABLE)	X				
Set_Safehold_Response_A (TRMM Command)				X	
Set_Safehold_Response_B (TRMM Command)				X	
Set_SPS1_Response					X
Set_SPS2_Response					X
Set_SPS1_Threshold_Noise					X
Set_SPS2_Threshold_Noise					X
Set_SPS1_Threshold_Numerator					X
Set_SPS2_Threshold_Numerator					X
Set_SPS1_Threshold_Count					X
Set_SPS2_Threshold_Count					X
Set_Scan_Timeout_Response					X (?)
Set_Scan_Timeout_Count		X			
Set_Quicklook_Flag	X				
Select_Time_Mark_Frequency_Bus (EOS-AM Command)					X (?)
Set_Time_Mark_Frequency_Response (EOS-AM Command)					X (?)
Set_IMOK_Signal_Response (EOS-AM Command)					X (?)
Set_Watchdog_Timer_ICP					X

Table 4-24. TRMM Instrument Commands Allowed by Mode (Sheet 3 of 5)

Command Description	All Modes	All Modes (except Safe)	All Modes (except Safe & Diagnostic)	Safe or Diagnostic Modes Only	Diagnostic Mode Only
Set_PROM_Power_ICP					X
Set_Mem_Dump_Start_Offset_ICP		X			
Set_Mem_Dump_Start_Segment_ICP		X			
Set_Mem_Dump_End_Offset_ICP		X			
Set_Mem_Dump_End_Segment_ICP		X			
Set_Azimuth_Encoder_LED					X
Set_Azimuth_Offset_Correction					X
Set_Azimuth_Stall_Error_Thres					X
Set_Azimuth_Stall_Count_Thres					X
Set_Packet_Data_Type	X				
Low_Rate_Science_Transfer_Enable (EOS-AM Command)					X (?)
No_Command_DAP	X (?)				
Set_Scan_Mode		X			
Command_Cover_Main					X
Command_Cover_MAM					X
Set_SWICS_Intensity		X			
Set_Blackbody_Temp_Setpoint		X			
Set_Blackbody_Temp_Control		X			
Set_Tot_Brid_Bal_Coarse_DAC_Val					X
Set_SW_Brid_Bal_Coarse_DAC_Val					X
Set_WN_Brid_Bal_Coarse_DAC_Val					X
Set_Tot_Brid_Bal_Fine_DAC_Val					X
Set_SW_Brid_Bal_Fine_DAC_Val					X
Set_WN_Brid_Bal_Fine_DAC_Val					X
Set_Tot_Brid_Bal_Control_Mode					X
Set_SW_Brid_Bal_Control_Mode					X
Set_WN_Brid_Bal_Control_Mode					X
Set_Tot_Sensor_Temp_Setpoint					X
Set_SW_Sensor_Temp_Setpoint					X
Set_WN_Sensor_Temp_Setpoint					X
Set_Tot_Sensor_Temp_Control	X (?)				
Set_SW_Sensor_Temp_Control	X (?)				
Set_WN_Sensor_Temp_Control	X (?)				

Table 4-24. TRMM Instrument Commands Allowed by Mode (Sheet 4 of 5)

Command Description	All Modes	All Modes (except Safe)	All Modes (except Safe & Diagnostic)	Safe or Diagnostic Modes Only	Diagnostic Mode Only
Set_Tot_Sensor_Temp_Coef_A0					X
Set_SW_Sensor_Temp_Coef_A0					X
Set_WN_Sensor_Temp_Coef_A0					X
Set_Tot_Sensor_Temp_Coef_A1					X
Set_SW_Sensor_Temp_Coef_A1					X
Set_WN_Sensor_Temp_Coef_A1					X
Set_Tot_Sensor_Temp_Coef_B1					X
Set_SW_Sensor_Temp_Coef_B1					X
Set_WN_Sensor_Temp_Coef_B1					X
Set_Tot_Sensor_Temp_Coef_D0					X
Set_SW_Sensor_Temp_Coef_D0					X
Set_WN_Sensor_Temp_Coef_D0					X
Set_Main_Cover_Active_Pos_Sensor					X
Step_Main_Cover_To_Open					X
Step_MAM_Cover_To_Open					X
Step_Main_Cover_To_Closed					X
Step_MAM_Cover_To_Closed					X
Set_Main_Cover_Sensor_1_Lag_Error					X
Set_Main_Cover_Sensor_2_Lag_Error					X
Set_Submux_Control					X
Set_Submux_Fixed_Channel					X
Set_Elevation_Stow_Pos					X
Set_Watchdog_Timer_DAP					X
Set_PROM_Power_DAP					X
Set_Mem_Dump_Start_Offset_DAP		X			
Set_Mem_Dump_Start_Segment_DAP		X			
Set_Mem_Dump_End_Offset_DAP		X			
Set_Mem_Dump_End_Segment_DAP		X			
Set_Elevation_Encoder_LED					X
Set_Elevation_Offset_Correction					X
Set_Elevation_Stall_Error_Thres					X
Set_Elevation_Stall_Count_Thres					X
ICP_Memory_Load					X
ICP_Sequence_Table_Load					X

Table 4-24. TRMM Instrument Commands Allowed by Mode (Sheet 5 of 5)

Command Description	All Modes	All Modes (except Safe)	All Modes (except Safe & Diagnostic)	Safe or Diagnostic Modes Only	Diagnostic Mode Only
ICP_Unique_Data_Load					X
DAP_Memory_Load					X
DAP_Unique_Data_Load					X
DAP_Scan_Table_Load					X

BDS Vdata

Temperature Counts (RTD) - This data set contain the raw count values for instrument temperature parameters, copied from the level-0 input data files. The data descriptions following the table apply to both the Temperature Counts (RTD) Table 4-25 parameters and the Converted Temperatures (CTD) listed in Table 4-28. The Link Number TD is hyperlinked from the tables to the parameter definition. The HDF Field Numbers RTD and CTD are included after the parameter name in the definitions for your reference.

Table 4-25. Temperature Counts (RTD)

Link	Field No.	Field Name / Parameter	Data Type	Units	Range	No. of Components
TD-1	1	Total Channel Heater DAC Value	U16 Integer	count	0..4095	12
TD-2	2	SW Channel Heater DAC Value	U16 Integer	count	0..4095	12
TD-3	3	WN Channel Heater DAC Value	U16 Integer	count	0..4095	12
TD-4	4	Blackbody Heater DAC Value	U16 Integer	count	0..4095	12
TD-5	5	Total Detector Control Temperature	U16 Integer	count	0..4095	12
TD-6	6	Total Detector Monitor Temperature	U16 Integer	count	0..4095	12
TD-7	7	SW Detector Control Temperature	U16 Integer	count	0..4095	12
TD-8	8	SW Detector Monitor Temperature	U16 Integer	count	0..4095	12
TD-9	9	WN Detector Control Temperature	U16 Integer	count	0..4095	12
TD-10	10	WN Detector Monitor Temperature	U16 Integer	count	0..4095	12
TD-11	11	Total Blackbody Temperature	U16 Integer	count	0..4095	12
TD-12	12	WN Blackbody Temperature	U16 Integer	count	0..4095	12
TD-13	13	Elevation Spindle Temperature - Motor	U16 Integer	count	0..4095	3
TD-14	14	Elevation Spindle Temperature - CW	U16 Integer	count	0..4095	3
TD-15	15	Elevation Bearing Temperature - Motor	U16 Integer	count	0..4095	3
TD-16	16	Elevation Bearing Temperature - CW	U16 Integer	count	0..4095	3
TD-17	17	SWICS Photodiode Temperature	U16 Integer	count	0..4095	3
TD-18	18	Sensor Module Temperature	U16 Integer	count	0..4095	3
TD-19	19	Sensor Electronics Temperature	U16 Integer	count	0..4095	3
TD-20	20	Main Cover Motor Temperature	U16 Integer	count	0..4095	3
TD-21	21	MAM Total Baffle Temperature 1	U16 Integer	count	0..4095	3
TD-22	22	MAM Total Baffle Temperature 2	U16 Integer	count	0..4095	3
TD-23	23	MAM Assembly SW Temperature	U16 Integer	count	0..4095	3
TD-24	24	MAM Assembly Total Temperature	U16 Integer	count	0..4095	3
TD-25	25	DAA Radiator Temperature	U16 Integer	count	0..4095	3
TD-26	26	DAA Processor Electronics Temperature	U16 Integer	count	0..4095	3
TD-27	27	DAA ADC Electronics Temperature	U16 Integer	count	0..4095	3
TD-28	28	ECA Radiator Temperature	U16 Integer	count	0..4095	3
TD-29	29	ECA Electronics Temperature	U16 Integer	count	0..4095	3
TD-30	30	ACA Electronics Temperature	U16 Integer	count	0..4095	3
TD-31	31	Azimuth Lower Bearing Temperature	U16 Integer	count	0..4095	3
TD-32	32	Azimuth Upper Bearing Temperature	U16 Integer	count	0..4095	3
TD-33	33	ICA Radiator Temperature	U16 Integer	count	0..4095	3
TD-34	34	ICA Processor Electronics Temperature	U16 Integer	count	0..4095	3
TD-35	35	ICA ADC Electronics Temperature	U16 Integer	count	0..4095	3
TD-36	36	PCA Radiator Temperature	U16 Integer	count	0..4095	3
TD-37	37	PCA Electronics Temperature	U16 Integer	count	0..4095	3

Table 4-25. Temperature Counts (RTD)

Link	Field No.	Field Name / Parameter	Data Type	Units	Range	No. of Components
TD-38	38	Pedestal Temperature 1 - Brake Housing	U16 Integer	count	0..4095	3
TD-39	39	Pedestal Temperature 2 - Isolator	U16 Integer	count	0..4095	3

Raw and Converted Temperature Definitions:

TD-1 Total Channel Heater DAC Value (RTD-1)

This parameter represents the commanded power value used to control the heatsink temperature. This value is derived from internal flight code equations that use the A0, A1, B1, and D0 commanded coefficients. See Flight Code Heater Algorithm for derivation as copied from the operations manual.

TD-2 SW Channel Heater DAC Value (RTD-2)

This parameter represents the commanded power value used to control the heatsink temperature. This value is derived from internal flight code equations that use the A0, A1, B1, and D0 commanded coefficients. See Flight Code Heater Algorithm for derivation as copied from the operations manual.

TD-3 WN Channel Heater DAC Value (RTD-3) -

This parameter represents the commanded power value used to control the heatsink temperature. This value is derived from internal flight code equations that use the A0, A1, B1, and D0 commanded coefficients. See Flight Code Heater Algorithm for derivation as copied from the operations manual.

TD-4 Blackbody Heater DAC Value (RTD-4) -

This parameter represents the commanded power value used to control the heatsink temperature. This value is derived from internal flight code equations that use the A0, A1, B1, and D0 commanded coefficients. See Flight Code Heater Algorithm for derivation as copied from the operations manual.

TD-5 Total Detector Control Temperature (RTD-5, CTD-1) -

This parameter indicates the temperature measured by the detector’s heatsink control sensor. This sensor is the primary monitoring sensor and the converted value is used by the radiometric count conversion process. The converted value is computed using DRL-64 algorithm 2. For the exact location of this sensor, see DRL-64 (Reference 8).

TD-6 Total Detector Monitor Temperature (RTD-6, CTD-2) -

This parameter indicates the temperature measured by the detector’s heatsink monitor sensor. This secondary sensor is used by the heatsink temperature control algorithm for maintaining the required tight temperatures. (See section on heatsink temperature algorithms for operational details.) The converted value is computed using DRL-64 algorithm 3.A. For the exact location of this sensor, see DRL-64 (Reference 8).

TD-7 SW Detector Control Temperature (RTD-7, CTD-3) -

This parameter indicates the temperature measured by the detector's heatsink control sensor. This sensor is the primary monitoring sensor and the converted value is used by the radiometric count conversion process. The converted value is computed using DRL-64 Algorithm 2 - For the Sensor Control Temperature channels: For the exact location of this sensor, see DRL-64 (Reference 8).

TD-8 SW Detector Monitor Temperature (RTD-8, CTD-4) -

This parameter indicates the temperature measured by the detector's heatsink monitor sensor. This secondary sensor is used by the heatsink temperature control algorithm for maintaining the required tight temperatures. The converted value is computed using DRL-64 algorithm 3.A. (See section on heatsink temperature for operational details.) For the exact location of this sensor, see DRL-64 (Reference 8).

TD-9 WN Detector Control Temperature (RTD-9, CTD-5) -

This parameter indicates the temperature measured by the detector's heatsink control sensor. This sensor is the primary monitoring sensor and the converted value is used by the radiometric count conversion process. The converted value is computed using DRL-64 Algorithm 2 - For the Sensor Control Temperature channels: For the exact location of this sensor, see DRL-64 (Reference 8).

TD-10 WN Detector Monitor Temperature (RTD-10, CTD-6) -

This parameter indicates the temperature measured by the detector's heatsink monitor sensor. This secondary sensor is used by the heatsink temperature control algorithm for maintaining the required tight temperatures. The converted value is computed using DRL-64 algorithm 3.A. (See section on heatsink temperature algorithms for operational details.) For the exact location of this sensor, see DRL-64 (Reference 8).

TD-11 Total Blackbody Temperature (RTD-11, CTD-7) -

This parameter indicates the temperature measured by the blackbody's heatsink sensor. This sensor is the primary sensor used by the temperature control algorithm to maintaining the required blackbody temperatures. There is no secondary sensor, though the WN blackbody sensor is available. The converted value is computed using DRL-64 Algorithm 1 - For the blackbody PRT channels: (See section on heatsink temperature algorithms for operational details.) For the exact location of this sensor, see DRL-64 (Reference 8).

TD-12 WN Blackbody Temperature (RTD-12, CTD-8) -

This parameter indicates the temperature measured by the blackbody's heatsink sensor. The converted value is computed using DRL-64 Algorithm 1 - For the blackbody PRT channels: (See section on heatsink temperature algorithms for operational details.) For the exact location of this sensor, see DRL-64 (Reference 8).

TD-13 Elevation Spindle Temperature-Motor (RTD-13, CTD-9) -

This parameter indicates the temperature on the elevation gimbal spindle (motor side). The spindle is the mounting plate for the three detector sensor assemblies. The converted value is computed using DRL-64 algorithm 3.B. For the exact location of this sensor, see DRL-64 (Reference 8).

TD-14 Elevation Spindle Temperature-CW (RTD-14, CTD-10) -

This parameter indicates the temperature on the elevation gimbal spindle (cable wrap side). The spindle is the mounting plate for the three detector sensor assemblies. The converted value is computed using DRL-64 algorithm 3.B. For the exact location of this sensor, see DRL-64 (Reference 8).

TD-15 Elevation Bearing Temperature-Motor (RTD-15, CTD-11) -

This parameter indicates the temperature on the elevation gimbal bearing assembly (motor side). Used to monitor friction buildups. The converted value is computed using DRL-64 algorithm 3.C. For the exact location of this sensor, see DRL-64 (Reference 8).

TD-16 Elevation Bearing Temperature-CW (RTD-16, CTD-12) -

This parameter indicates the temperature on the elevation gimbal bearing assembly (cable side). Used to monitor friction buildups. The converted value is computed using DRL-64 algorithm 3.C. For the exact location of this sensor, see DRL-64 (Reference 8).

TD-17 SWICS Photodiode Temperature (RTD-17, CTD-13) -

This parameter indicates the temperature of the SWICS photodiode mounting base. The mounting base is not temperature controlled. The converted value is computed using DRL-64 algorithm 3.C. For the exact location of this sensor, see DRL-64 (Reference 8).

TD-18 Sensor Module Temperature (RTD-18, CTD-14) -

This parameter indicates the temperature of the cantilever mounting plate that holds the detector sensor assembly. The sensor is mounted between the WN and SW assemblies. The converted value is computed using DRL-64 algorithm 3.B. For the exact location of this sensor, see DRL-64 (Reference 8).

TD-19 Sensor Electronics Temperature (RTD-19, CTD-15) -

This parameter indicates the temperature of the detector sensor front-end electronics printed circuit card. Since the bridge balance circuits are part of this circuitry, temperature variations may have an influence on the bolometer signals. The converted value is computed using DRL-64 algorithm 3.B. For the exact location of this sensor, see DRL-64 (Reference 8).

TD-20 Main Cover Motor Temperature (RTD-20, CTD-16) -

This parameter indicates the temperature of the main cover. The converted value is computed using DRL-64 algorithm 3.C. For the exact location of this sensor, see DRL-64 (Reference 8).

TD-21 MAM Total Baffle Temperature 1 (RTD-21, CTD-17) -

This parameter indicates the temperature near one end of the total channel MAM baffle assembly. The converted value is computed using DRL-64 algorithm 3.C. For the exact location of this sensor, see DRL-64 (Reference 8).

TD-22 MAM Total Baffle Temperature 2 (RTD-22, CTD-18) -

This parameter indicates the temperature near the other end of the total channel MAM baffle assembly. The converted value is computed using DRL-64 algorithm 3.C. For the exact location of this sensor, see DRL-64 (Reference 8).

TD-23 MAM Assembly SW Temperature (RTD-23, CTD-19) -

This parameter indicates the temperature of the SW MAM backing plate. The converted value is computed using DRL-64 algorithm 3.C. For the exact location of this sensor, see DRL-64 (Reference 8).

TD-24 MAM Assembly Total Temperature (RTD-24, CTD-20) -

This parameter indicates the temperature of the total MAM backing plate. The converted value is computed using DRL-64 algorithm 3.C. For the exact location of this sensor, see DRL-64 (Reference 8).

TD-25 DAA Radiator Temperature (RTD-25, CTD-21) -

This parameter indicates the temperature of the radiator plate for the data acquisition assembly circuit board. The converted value is computed using DRL-64 algorithm 3.B. For the exact location of this sensor, see DRL-64 (Reference 8).

TD-26 DAA Processor Electronics Temperature (RTD-26, CTD-22) -

This parameter indicates the temperature of the data acquisition assembly microprocessor electronics. The converted value is computed using DRL-64 algorithm 3.C. For the exact location of this sensor, see DRL-64 (Reference 8).

TD-27 DAA ADC Electronics Temperature (RTD-27, CTD-23) -

This parameter indicates the temperature of the data acquisition assembly analog to digital conversion electronics. The converted value is computed using DRL-64 algorithm 3.C. For the exact location of this sensor, see DRL-64 (Reference 8).

TD-28 ECA Radiator Temperature (RTD-28, CTD-24) -

This parameter indicates the temperature of the radiator plate for the elevation control assembly circuit board. The converted value is computed using DRL-64 algorithm 3.C. For the exact location of this sensor, see DRL-64 (Reference 8).

TD-29 ECA Electronics Temperature (RTD-29, CTD-25) -

This parameter indicates the temperature of the elevation control assembly electronics. The converted value is computed using DRL-64 algorithm 3.C. For the exact location of this sensor, see DRL-64 (Reference 8).

TD-30 ACA Electronics Temperature (RTD-30, CTD-26) -

This parameter indicates the temperature of the azimuth control assembly electronics. The converted value is computed using DRL-64 algorithm 3.C. For the exact location of this sensor, see DRL-64 (Reference 8).

TD-31 Azimuth Lower Bearing Temperature (RTD-31, CTD-27) -

This parameter indicates the temperature of the lower azimuth gimbal bearing assembly. Used to monitor friction buildups. The converted value is computed using DRL-64 algorithm 3.C. For the exact location of this sensor, see DRL-64 (Reference 8).

TD-32 Azimuth Upper Bearing Temperature (RTD-32, CTD-28) -

This parameter indicates the temperature for the upper azimuth gimbal bearing assembly. Used to monitor friction buildups. The converted value is computed using DRL-64 algorithm 3.C. For the exact location of this sensor, see DRL-64 (Reference 8).

TD-33 ICA Radiator Temperature (RTD-33, CTD-29) -

This parameter indicates the temperature of the radiator for the instrument controller assembly circuit board. The converted value is computed using DRL-64 algorithm 3.C. For the exact location of this sensor, see DRL-64 (Reference 8).

TD-34 ICA Processor Electronics Temperature (RTD-34, CTD-30) -

This parameter indicates the temperature of the instrument controller assembly microprocessor electronics. The converted value is computed using DRL-64 algorithm 3.C. For the exact location of this sensor, see DRL-64 (Reference 8).

TD-35 ICA ADC Electronics Temperature (RTD-35, CTD-31) -

This parameter indicates the temperature of the instrument controller assembly analog to digital conversion electronics. The converted value is computed using DRL-64 algorithm 3.C. For the exact location of this sensor, see DRL-64 (Reference 8).

TD-36 PCA Radiator Temperature (RTD-36, CTD-32) -

This parameter indicates the temperature for the radiator for the power converter assembly circuit board. The converted value is computed using DRL-64 algorithm 3.C. For the exact location of this sensor, see DRL-64 (Reference 8).

TD-37 PCA Electronics Temperature (RTD-37, CTD-33) -

This parameter indicates the temperature of the power converter assembly electronics. The converted value is computed using DRL-64 algorithm 3.C. For the exact location of this sensor, see DRL-64 (Reference 8).

TD-38 Pedestal Temperature 1-Brake Housing (RTD-38, CTD-34) -

This parameter indicates the temperature of the instrument's pedestal mount for the azimuth's brake assembly. The converted value is computed using DRL-64 algorithm 3.C. For the exact location of this sensor, see DRL-64 (Reference 8).

TD-39 Pedestal Temperature 2-Isolator (RTD-39, CTD-35) -

This parameter indicates the temperature of the instrument's pedestal mount near the spacecraft mounting interface. The converted value is computed using DRL-64 algorithm 3.C. For the exact location of this sensor, see DRL-64 (Reference 8).

Voltage and Torque Counts (RVTD) - This data set contains the raw count values for instrument voltage, current, and gimbal torque parameters, copied from the level-0 input data files.

Table 4-26. Voltage and Torque Counts (RVTD)

Link	Field No.	Field Name / Parameter	Data Type	Units	Range	No. of Components
VT-1	1	Detector +120V Bias	U16 Integer	count	0..4095	3
VT-2	2	Detector -120V Bias	U16 Integer	count	0..4095	3
VT-3	3	SWICS Photodiode Output	U16 Integer	count	0..4095	3
VT-4	4	SWICS Lamp Current	U16 Integer	count	0..4095	3
VT-5	5	ICA +5V Digital	U16 Integer	count	0..4095	3
VT-6	6	ICA +15V to ECA/ACA	U16 Integer	count	0..4095	3
VT-7	7	ICA -15V to ECA/ACA	U16 Integer	count	0..4095	3
VT-8	8	ICA + 5V Analog	U16 Integer	count	0..4095	3
VT-9	9	ICA +10V Bias	U16 Integer	count	0..4095	3
VT-10	10	ICA +15V Internal	U16 Integer	count	0..4095	3
VT-11	11	ICA -15V Internal	U16 Integer	count	0..4095	3
VT-12	12	DAA Ground Reference 1	U16 Integer	count	0..4095	3
VT-13	13	DAA Ground Reference 2	U16 Integer	count	0..4095	3
VT-14	14	DAA -10V Reference	U16 Integer	count	0..4095	3
VT-15	15	DAA +130V	U16 Integer	count	0..4095	3
VT-16	16	DAA -130V	U16 Integer	count	0..4095	3
VT-17	17	DAA +12V	U16 Integer	count	0..4095	3
VT-18	18	DAA -12V	U16 Integer	count	0..4095	3
VT-19	19	DAA +15V	U16 Integer	count	0..4095	3
VT-20	20	DAA -15V	U16 Integer	count	0..4095	3
VT-21	21	DAA +5V	U16 Integer	count	0..4095	3
VT-22	22	DAA +10V Reference	U16 Integer	count	0..4095	3
VT-23	23	ECA Torque Output	U16 Integer	count	0..4095	12
VT-24	24	ACA Torque Output	U16 Integer	count	0..4095	12

Voltage and Torque Counts (RVTD) Definitions:

The following data descriptions apply to both the Voltage and Torque Counts (RVTD) Table 4-26 parameters and the Converted Voltages and Torques (CVTD) listed in Table 4-29. The Link Number VT is hyperlinked from the tables to the parameter definition. The HDF Field Numbers RVTD and CVTD are included after the parameter name for your reference.

VT-1 Detector +120V Bias (RVTD-1, CVTD-1) -

This parameter indicates the voltage for the detector bridge balance circuitry. The converted value is computed using DRL-64 (Reference 8) algorithm 4 Linear Coefficients listed in Table 8-3 Sub-type E.

VT-2 Detector -120V Bias (RVTD-2, CVTD-2) -

This parameter indicates the voltage for the detector bridge balance circuitry. The converted value is computed using DRL-64 (Reference 8) algorithm 4 Linear Coefficients listed in Table 8-3 Sub-type F.

VT-3 SWICS Photodiode Output (RVTD-3) -

This parameter indicates the digital counts sent to the SWICS lamp driver circuitry. This value should be zero when the lamp is off. When the lamp is on, the values for each intensity level is approximately 170, 1401, and 3145 +/- 1count, which corresponds roughly to 100, 250, and 400 $Wm^{-2}sr^{-1}$, respectively.

VT-4 SWICS Lamp Current (RVTD-4, CVTD-3) -

This parameter indicates the current being drawn by the SWICS photodiode lamp. Values should be seen only when an internal calibration is performed. The converted value is computed using DRL-64 (Reference 8) algorithm 4 Linear Coefficients listed in Table 8-3 Sub-type L.

VT-5 ICA +5V Digital (RVTD-5, CVTD-5) -

This parameter indicates the voltage supplied to the instrument controller assembly electronics. The converted value is computed using DRL-64 (Reference 8) algorithm 4 Linear Coefficients listed in Table 8-3 Sub-type J.

VT-6 ICA +15V to ECA/ACA (RVTD-6, CVTD-5) -

This parameter indicates the voltage supplied to the elevation and azimuth control assembly electronics. This voltage is used for the gimbal drives. The converted value is computed using DRL-64 (Reference 8) algorithm 4 Linear Coefficients listed in Table 8-3 Sub-type A.

VT-7 ICA -15V to ECA/ACA (RVTD-7, CVTD-6) -

This parameter indicates the voltage supplied to the elevation and azimuth control assembly electronics. This voltage is used for the gimbal drives. The converted value is computed using DRL-64 (Reference 8) algorithm 4 Linear Coefficients listed in Table 8-3 Sub-type B.

VT-8 ICA + 5V Analog (RVTD-8, CVTD-7) -

This parameter indicates the voltage used by the instrument controller assembly analog electronics. These electronics include, for example, the opto-isolator drivers for the ICA/DAA cable wrap. The converted value is computed using DRL-64 (Reference 8) algorithm 4 Linear Coefficients listed in Table 8-3 Sub-type J.

VT-9 ICA +10V Bias (RVTD-9, CVTD-8) -

This parameter indicates the voltage used by the instrument controller assemblies analog to digital converter as a reference signal. The converted value is computed using DRL-64 (Reference 8) algorithm 4 Linear Coefficients listed in Table 8-3 Sub-type O.

VT-10 ICA +15V Internal (RVTD-10, CVTD-9) -

This parameter indicates the voltage used by the instrument controller assembly. The converted value is computed using DRL-64 (Reference 8) algorithm 4 Linear Coefficients listed in Table 8-3 Sub-type A.

VT-11 ICA -15V Internal (RVTD-11, CVTD-10) -

This parameter indicates the voltage used by the instrument controller assembly. The converted value is computed using DRL-64 (Reference 8) algorithm 4 Linear Coefficients listed in Table 8-3 Sub-type B.

VT-12 DAA Ground Reference 1 (RVTD-12, CVTD-11) -

This parameter indicates the voltage on the digital acquisition assembly's ground plane. Since the detector bridge balances are referenced to ground, any ground loop power may affect the radiometric measurements. The converted value is computed using DRL-64 (Reference 8) algorithm 4 Linear Coefficients listed in Table 8-3 Sub-type J.

VT-13 DAA Ground Reference 2 (RVTD-13, CVTD-12) -

This parameter indicates the voltage on the digital acquisition assembly's ground plane. Since the detector bridge balances are referenced to ground, any ground loop power may affect the radiometric measurements. The converted value is computed using DRL-64 (Reference 8) algorithm 4 Linear Coefficients listed in Table 8-3 Sub-type J.

VT-14 DAA -10V Reference (RVTD-14VTD-13) -

This parameter indicates the voltage on the digital acquisition assembly's ground plane. Since the detector bridge balances are referenced to ground, any ground loop power may affect the radiometric measurements. The converted value is computed using DRL-64 (Reference 8) algorithm 4 Linear Coefficients listed in Table 8-3 Sub-type B.

VT-15 DAA +130V (RVTD-15, CVTD-14) -

This parameter indicates the voltage supplied the power regulators that produces the detector 120 volt bias parameter. The converted value is computed using DRL-64 (Reference 8) algorithm 4 Linear Coefficients listed in Table 8-3 Sub-type C.

VT-16 DAA -130V (RVTD-16, CVTD-15) -

This parameter indicates the voltage supplied the power regulators that produces the detector 120 volt bias parameter. The converted value is computed using DRL-64 (Reference 8) algorithm 4 Linear Coefficients listed in Table 8-3 Sub-type D.

VT-17 DAA +12V (RVTD-17, CVTD-16) -

This parameter indicates the voltage supplied to the data acquisition assemblies analog electronics. This voltage is typically used for the preamp circuitries. The converted value is computed using DRL-64 (Reference 8) algorithm 4 Linear Coefficients listed in Table 8-3 Sub-type A.

VT-18 DAA -12V (RVTD-18, CVTD-17) -

This parameter indicates the voltage supplied to the data acquisition assemblies analog electronics. This voltage is typically used for the preamp circuitries. The converted value is computed using DRL-64 (Reference 8) algorithm 4 Linear Coefficients listed in Table 8-3 Sub-type B.

VT-19 DAA +15V (RVTD-19, CVTD-18) -

This parameter indicates the voltage supplied to the data acquisition assemblies electronics. The converted value is computed using DRL-64 (Reference 8) algorithm 4 Linear Coefficients listed in Table 8-3 Sub-type A.

VT-20 DAA -15V (RVTD-20, CVTD-19) -

This parameter indicates the voltage supplied to the data acquisition assemblies electronics. The converted value is computed using DRL-64 (Reference 8) algorithm 4 Linear Coefficients listed in Table 8-3 Sub-type B.

VT-21 DAA +5V (RVTD-21, CVTD-20) -

This parameter indicates the voltage supplied to the data acquisition assemblies digital electronics. The converted value is computed using DRL-64 (Reference 8) algorithm 4 Linear Coefficients listed in Table 8-3 Sub-type J.

VT-22 DAA +10V Reference (RVTD-22, CVTD-21) -

This parameter indicates the voltage on the digital acquisition assembly's ground plane. Since the detector bridge balances are referenced to ground, any ground loop power may affect the radiometric measurements. The converted value is computed using DRL-64 (Reference 8) algorithm 4 Linear Coefficients listed in Table 8-3 Sub-type G.

VT-23 ECA Torque Output (RVTD-23, CVTD-22) -

This parameter indicates the elevation gimbal torque converted to a servo controller signal. The converted value is computed using DRL-64 (Reference 8) algorithm 4 Linear Coefficients listed in Table 8-3 Sub-type H.

VT-24 ACA Torque Output (RVTD-24, CVTD-23) -

This parameter indicates the azimuth gimbal torque converted to a servo controller signal. The converted value is computed using DRL-64 (Reference 8) algorithm 4 Linear Coefficients listed in Table 8-3 Sub-type I.

Position Counts (RPC) - This data set contains the raw count values for instrument gimbal, covers, and solar position parameters, copied from the level-0 input data files.

Table 4-27. Position Counts (RPC)

Link	Field No.	Field Name / Parameter	Data Type	Units	Range	No. of Components
RPC-1	1	ACA Encoder Clear Track A	U16 Integer	count	0..4095	3
RPC-2	2	ACA Encoder Clear Track B	U16 Integer	count	0..4095	3
RPC-3	3	ECA Encoder Clear Track A	U16 Integer	count	0..4095	3
RPC-4	4	ECA Encoder Clear Track B	U16 Integer	count	0..4095	3
RPC-5	5	Main Cover Position 1	U16 Integer	count	0..4095	3
RPC-6	6	Main Cover Position 2	U16 Integer	count	0..4095	3
RPC-7	7	MAM Cover Position	U16 Integer	count	0..4095	3
RPC-8	8	Azimuth Brake Position	U16 Integer	count	0..4095	3
RPC-9	9	SPS 1 Narrow FOV	U16 Integer	count	0..4095	60
RPC-10	10	SPS 1 Wide FOV	U16 Integer	count	0..4095	60
RPC-11	11	SPS 2 Narrow FOV	U16 Integer	count	0..4095	60
RPC-12	12	SPS 2 Wide FOV	U16 Integer	count	0..4095	60

DATA DESCRIPTIONS (Referenced by Field Number):

RPC-1 ACA Encoder Clear Track A (RPC-1) -

This parameter indicates the raw count value for the azimuth encoder track A as read from the LED.

RPC-2 ACA Encoder Clear Track B (RPC-2) -

This parameter indicates the raw count value for the azimuth encoder track B as read from the LED.

RPC-3 ECA Encoder Clear Track A (RPC-3) -

This parameter indicates the raw count value for the elevation encoder track A as read from the LED.

RPC-4 ECA Encoder Clear Track B (RPC-4) -

This parameter indicates the raw count value for the elevation encoder track B as read from the LED.

RPC-5 Main Cover Position 1 (RPC-5) -

This parameter indicates the raw count value for the linear screw drive encoder for the main cover rail number 1.

RPC-6 Main Cover Position 2 (RPC-6) -

This parameter indicates the raw count value for the linear screw drive encoder for the main cover rail number 2.

RPC-7 MAM Cover Position (RPC-7) -

This parameter indicates the raw count value for the MAM cover drive encoder.

RPC-8 Azimuth Brake Position (RPC-8) -

This parameter indicates the raw count value for the brake position encoder.

RPC-9 SPS 1 Narrow FOV (RPC-9) -

This parameter indicates the count value for any detected light sources as seen by the narrow field-of-view on solar presence sensor number 1.

RPC-10 SPS 1 Wide FOV (RPC-10) -

This parameter indicates the count value for any detected light sources as seen by the wide field-of-view on solar presence sensor number 1.

RPC-11 SPS 2 Narrow FOV (RPC-11) -

This parameter indicates the count value for any detected light sources as seen by the narrow field-of-view on solar presence sensor number 2.

RPC-12 SPS 2 Wide FOV (RPC-12) -

This parameter indicates the count value for any detected light sources as seen by the wide field-of-view on solar presence sensor number 2.

Converted Temperatures (CTD) - This data set contains the converted values (typically degrees C) for instrument temperature parameters that have defined conversion algorithms. The data descriptions apply to both the Temperature Counts (RTD) Table 4-25 parameters and the Converted Temperatures (CTD) listed in Table 4-28. The Link Number TD is hyperlinked from the tables to the parameter definition. The HDF Field Numbers RTD and CTD are included after the parameter name for your reference.

Table 4-28. Converted Temperatures (CTD)

Link	Field No.	Field Name / Parameter	Data Type	Units	Range	No. of Com-ponent	Conversion Algorithm per DRL-64
TD-5	1	Total Detector Control Temperature	32-Bit Float	°C	36.0..40.0	12	2.
TD-6	2	Total Detector Monitor Temperature	32-Bit Float	°C	36.0..40.0	12	3.A
TD-7	3	SW Detector Control Temperature	32-Bit Float	°C	36.0..40.0	12	2.
TD-8	4	SW Detector Monitor Temperature	32-Bit Float	°C	36.0..40.0	12	3.A
TD-9	5	WN Detector Control Temperature	32-Bit Float	°C	36.0..40.0	12	2.
TD-10	6	WN Detector Monitor Temperature	32-Bit Float	°C	36.0..40.0	12	3.A
TD-11	7	Total Blackbody Temperature	32-Bit Float	°C	-15.0..60.0	12	1.
TD-12	8	WN Blackbody Temperature	32-Bit Float	°C	-15.0..60.0	12	1.
TD-13	9	Elevation Spindle Temperature - Motor	32-Bit Float	°C	-30.0..70.0	3	3.B
TD-14	10	Elevation Spindle Temperature - CW	32-Bit Float	°C	-30.0..70.0	3	3.B
TD-15	11	Elevation Bearing Temperature - Motor	32-Bit Float	°C	-30.0..70.0	3	3.C
TD-16	12	Elevation Bearing Temperature - CW	32-Bit Float	°C	-30.0..70.0	3	3.C
TD-17	13	SWICS Photodiode Temperature	32-Bit Float	°C	-30.0..70.0	3	3.C
TD-18	14	Sensor Module Temperature	32-Bit Float	°C	-30.0..70.0	3	3.B
TD-19	15	Sensor Electronics Temperature	32-Bit Float	°C	-30.0..70.0	3	3.B
TD-20	16	Main Cover Motor Temperature	32-Bit Float	°C	-30.0..70.0	3	3.C
TD-21	17	MAM Total Baffle Temperature 1	32-Bit Float	°C	-30.0..70.0	3	3.C
TD-22	18	MAM Total Baffle Temperature 2	32-Bit Float	°C	-30.0..70.0	3	3.C
TD-23	19	MAM Assembly SW Temperature	32-Bit Float	°C	-30.0..70.0	3	3.C
TD-24	20	MAM Assembly Total Temperature	32-Bit Float	°C	-30.0..70.0	3	3.C
TD-25	21	DAA Radiator Temperature	32-Bit Float	°C	-30.0..70.0	3	3.B
TD-26	22	DAA Processor Electronics Temperature	32-Bit Float	°C	-30.0..70.0	3	3.C
TD-27	23	DAA ADC Electronics Temperature	32-Bit Float	°C	-30.0..70.0	3	3.C
TD-28	24	ECA Radiator Temperature	32-Bit Float	°C	-30.0..70.0	3	3.C
TD-29	25	ECA Electronics Temperature	32-Bit Float	°C	-30.0..70.0	3	3.C
TD-30	26	ACA Electronics Temperature	32-Bit Float	°C	-30.0..70.0	3	3.C
TD-31	27	Azimuth Lower Bearing Temperature	32-Bit Float	°C	-30.0..70.0	3	3.C
TD-32	28	Azimuth Upper Bearing Temperature	32-Bit Float	°C	-30.0..70.0	3	3.C
TD-33	29	ICA Radiator Temperature	32-Bit Float	°C	-30.0..70.0	3	3.C
TD-34	30	ICA Processor Electronics Temperature	32-Bit Float	°C	-30.0..70.0	3	3.C
TD-35	31	ICA ADC Electronics Temperature	32-Bit Float	°C	-30.0..70.0	3	3.C
TD-36	32	PCA Radiator Temperature	32-Bit Float	°C	-30.0..70.0	3	3.C
TD-37	33	PCA Electronics Temperature	32-Bit Float	°C	-30.0..70.0	3	3.C
TD-38	34	Pedestal Temperature 1 - Brake Housing	32-Bit Float	°C	-30.0..70.0	3	3.C
TD-39	35	Pedestal Temperature 2 - Isolator	32-Bit Float	°C	-30.0..70.0	3	3.C

Converted Voltages and Torques (CVTD) Definitions: - This data set contains the converted values for instrument voltage, current, and gimbal torque parameters that have defined conversion algorithms. The following data descriptions apply to both the Voltage and Torque Counts (RVTD)

Table 4-26 parameters and the Converted Voltages and Torques (CVTD) listed in Table 4-29. The Link Number VT is hyperlinked from the tables to the parameter definition. The HDF Field Numbers RVTD and CVTD are included after the parameter name for your reference.

Table 4-29. Converted Voltages and Torques (CVTD)

Link	Field No.	Field Name / Parameter	Data Type	Units	Range	No. of Com-ponents	Conversion Algrorithm per DRL-64
VT-1	1	Detector +120V Bias	32-Bit Float	volt	115.0..125.0	3	4.E
VT-2	2	Detector -120V Bias	32-Bit Float	volt	-125.0..-115.0	3	4.F
VT-4	3	SWICS Lamp Current	32-Bit Float	mA	0.0..100.0	3	4.L
VT-5	4	ICA +5V Digital	32-Bit Float	volt	0.0..8.0	3	4.J
VT-6	5	ICA +15V to ECA/ACA	32-Bit Float	volt	0.0..20.0	3	4.A
VT-7	6	ICA -15V to ECA/ACA	32-Bit Float	volt	-20.0..0.0	3	4.B
VT-8	7	ICA +5V Analog	32-Bit Float	volt	0.0..20.0	3	4.J
VT-9	8	ICA +10V Bias	32-Bit Float	volt	-20.0..0.0	3	4.O
VT-10	9	ICA +15V Internal	32-Bit Float	volt	0.0..30.0	3	4.A
VT-11	10	ICA -15V Internal	32-Bit Float	volt	-30.0..0.0	3	4.B
VT-12	11	DAA Ground Reference 1	32-Bit Float	volt	0.0..10.0	3	4.J
VT-13	12	DAA Ground Reference 2	32-Bit Float	volt	0.0..10.0	3	4.J
VT-14	13	DAA -10V Reference	32-Bit Float	volt	-20.0..0.0	3	4.B
VT-15	14	DAA +130V	32-Bit Float	volt	90.0..170.0	3	4.C
VT-16	15	DAA -130V	32-Bit Float	volt	-224.0..-36.0	3	4.D
VT-17	16	DAA +12V	32-Bit Float	volt	0.0..20.0	3	4.A
VT-18	17	DAA -12V	32-Bit Float	volt	-20.0..0.0	3	4.B
VT-19	18	DAA +15V	32-Bit Float	volt	0.0..20.0	3	4.A
VT-20	19	DAA -15V	32-Bit Float	volt	-20.0..0.0	3	4.B
VT-21	20	DAA +5V	32-Bit Float	volt	0.0..20.0	3	4.J
VT-22	21	DAA +10V Reference	32-Bit Float	volt	-20.0..0.0	3	4.G
VT-23	22	Elevation Torque Output	32-Bit Float	in-oz	-20.0..20.0	12	4.H
VT-24	23	Azimuth Torque	32-Bit Float	in-oz	-20.0..20.0	12	4.I

Table 4-30. Satellite-Celestial Data (SCD)

Link	Field No.	Field Names / Parameters	Data Type	Units	Range	No. of Components
SCD-1	1	Satellite Position at record start	64-Bit Float	km	-8000..8000	3 (x, y, z)
SCD-2	2	Satellite Position at record end	64-Bit Float	km	-8000..8000	3 (x, y, z)
SCD-3	3	Satellite Velocity at record start	64-Bit Float	km sec^{-1}	-10.0..10.0	3 (x, y, z)
SCD-4	4	Satellite Velocity at record end	64-Bit Float	km sec^{-1}	-10.0..10.0	3 (x, y, z)
SCD-5	5	Colatitude of Satellite at record start	32-Bit Float	deg	0.0..180.0	1
SCD-6	6	Longitude of Satellite at record start	32-Bit Float	deg	0.0..360.0	1
SCD-7	7	Colatitude of Satellite at record end	32-Bit Float	deg	0.0..180.0	1
SCD-8	8	Longitude of Satellite at record end	32-Bit Float	deg	0.0..360.0	1
SCD-9	9	Earth-Sun Distance	64-Bit Float	AU	0.98..1.02	1
SCD-10	10	Colatitude of Sun at Observation	32-Bit Float	deg	0.0..180.0	1
SCD-11	11	Longitude of Sun at Observation	32-Bit Float	deg	0.0..360.0	1

Satellite-Celestial Data (SCD) - This data set contains spacecraft and celestial converted values. The data descriptions are hyperlinked from the Link column in the table.

SCD-1 Satellite Position at record start

This parameter indicates the x, y, z position of the satellite at the nadir point corresponding to the first measurement in the packet. The positions are referenced to the Earth-Centered-Reference (ECR) coordinate system. (See section Field-of-View Geolocation Calculations for further details.)

SCD-2 Satellite Position at record end

This parameter indicates the x, y, z position of the satellite at the nadir point corresponding to the last measurement in the packet. The positions are referenced to the Earth-Centered-Reference (ECR) coordinate system. (See section Field-of-View Geolocation Calculations for further details.)

SCD-3 Satellite Velocity at record start

This parameter indicates the x, y, z velocity of the satellite at the nadir point corresponding to the first measurement in the packet. The positions are referenced to the Earth-Centered-Reference (ECR) coordinate system. (See section Field-of-View Geolocation Calculations for further details.)

SCD-4 Satellite Velocity at record end

This parameter indicates the x, y, z velocity of the satellite at the nadir point corresponding to the last measurement in the packet. The positions are referenced to the Earth-Centered-Reference (ECR) coordinate system. (See section Field-of-View Geolocation Calculations for further details.)

SCD-5 Colatitude of Satellite at record start

This parameter indicates the colatitude of the satellite at the nadir point corresponding to the first measurement in the packet. The colatitude is referenced to the Earth-Centered-Reference (ECR) coordinate system. (See section Field-of-View Geolocation Calculations for further details.)

SCD-6 Longitude of Satellite at record start

This parameter indicates the longitude of the satellite at the nadir point corresponding to the first measurement in the packet. The longitude is referenced to the Earth-Centered-Reference (ECR) coordinate system. (See section Field-of-View Geolocation Calculations for further details.)

SCD-7 Colatitude of Satellite at record end

This parameter indicates the colatitude of the satellite at the nadir point corresponding to the last measurement in the packet. The colatitude is referenced to the Earth-Centered-Reference (ECR) coordinate system. (See section Field-of-View Geolocation Calculations for further details.)

SCD-8 Longitude of Satellite at record end

This parameter indicates the longitude of the satellite at the nadir point corresponding to the last measurement in the packet. The longitude is referenced to the Earth-Centered-Reference (ECR) coordinate system. (See section Field-of-View Geolocation Calculations for further details.)

SCD-9 Earth-Sun Distance

This parameter indicates the distance between the center of the Sun and the center of the Earth. This measurement is updated at the start of every packet. (See section Field-of-View Geolocation Calculations for further details.)

SCD-10 Colatitude of Sun at Observation

This parameter indicates the colatitude of the Sun at the nadir point corresponding to the first measurement in the packet. The colatitude is referenced to the Earth-Centered-Reference (ECR) coordinate system. (See section Field-of-View Geolocation Calculations for further details.)

SCD-11 Longitude of Sun at Observation

This parameter indicates the longitude of the Sun at the nadir point corresponding to the first measurement in the packet. The longitude is referenced to the Earth-Centered-Reference (ECR) coordinate system. (See section Field-of-View Geolocation Calculations for further details.)

Converted Digital Data (CDD) - This data set contains the converted values for instrument status parameters that have defined conversion algorithms. Packet information status that are not part of the raw digital status data block are also included in this data set.

Table 4-31. Converted Digital Data (CDD)

Link	Field No.	Field Names / Parameters	Data Type	Units	Range	No. of Com-ponents	Conversion Algorithm per DRL-64
CDD-1	1	Elevation Offset Correction	32-Bit Float	deg	0..360	1	1.
CDD-2	2	Azimuth Offset Correction	32-Bit Float	deg	0..360	1	4.K
CDD-3	3	Azimuth Defined Fixed Crosstrack Position	32-Bit Float	deg	0..360	1	4.K
CDD-3	4	Azimuth Defined Fixed Position A	32-Bit Float	deg	0..360	1	4.K
CDD-5	5	Azimuth Defined Fixed Position B	32-Bit Float	deg	0..360	1	4.K
CDD-6	6	Azimuth Defined Fixed Solar Cal Position	32-Bit Float	deg	0..360	1	4.K
CDD-7	7	Azimuth Defined Fixed Cage Position	32-Bit Float	deg	0..360	1	4.K
CDD-8	8	Azimuth Defined Fixed Position Spare 1	32-Bit Float	deg	0..360	1	4.K
CDD-9	9	Azimuth Defined Fixed Position Spare 2	32-Bit Float	deg	0..360	1	4.K
CDD-10	10	Azimuth Defined Fixed Position Spare 3	32-Bit Float	deg	0..360	1	4.K
CDD-11	11	Azimuth Defined Normal Slew Rate	32-Bit Float	deg sec^{-1}	4.0..6.0	1	7.
CDD-12	12	Azimuth Defined Asynchronous Scan Rate	32-Bit Float	deg sec^{-1}	4.0..6.0	1	7.
CDD-13	13	Azimuth Defined Synchronous Scan Rate	32-Bit Float	deg sec^{-1}	4.0..6.0	1	7.
CDD-14	14	Azimuth Position Error	32-Bit Float	deg	0..360	1	4.K
CDD-15	15	DAP Minimum Execution Time	32-Bit Float	msec	0.0..10.0	1	4.N
CDD-16	16	DAP Maximum Execution Time	32-Bit Float	msec	0.0..10.0	1	4.N
CDD-17	17	ICP Minimum Execution Time	32-Bit Float	msec	0.0..10.0	1	4.N
CDD-18	18	ICP Maximum Execution Time	32-Bit Float	msec	0.0..10.0	1	4.N
CDD-19	19	Instrument ID Number	U16 Integer	N/A	0..31	1	
CDD-20	20	Packet Data Indicator	U16 Integer	N/A	0..6	1	
CDD-21	21	Packet Data Version	U16 Integer	N/A	0..31	1	

Table 4-31. Converted Digital Data (CDD)

Link	Field No.	Field Names / Parameters	Data Type	Units	Range	No. of Com-ponents	Conversion Algorithm per DRL-64
CDD-22	22	Science Packet Quick Look Flag Status	U16 Integer	N/A	0..1	1	
CDD-23	23	Packet Timecode Indicator	U16 Integer	N/A	0..1	1	
CDD-24	24	Packet Counter - Relative	U16 Integer	N/A	1..32767	1	
CDD-25	25	Packet Counter - Absolute	U32 Integer	N/A	0..65536	1	

DATA DESCRIPTIONS (Referenced by Field Number):

CDD-1 Elevation Offset Correction (RDSM - 105, CDD - 1)

CDD-2 Azimuth Offset Correction (RDSM - 170, CDD - 2)

CDD-3 Azimuth Defined Fixed Crosstrack Position (RDSM - 158, CDD - 3)

CDD-4 Azimuth Defined Fixed Position A (RDSM - 159, CDD - 4)

CDD-5 Azimuth Defined Fixed Position B (RDSM - 160, CDD - 5)

CDD-6 Azimuth Defined Fixed Solar Cal Position (RDSM - 161, CDD - 6)

CDD-7 Azimuth Defined Fixed Cage Position (RDSM - 162, CDD - 7)

CDD-8 Azimuth Defined Fixed Position Spare 1 (RDSM - 163, CDD - 8)

CDD-9 Azimuth Defined Fixed Position Spare 2 (RDSM - 164, CDD - 9)

CDD-10 Azimuth Defined Fixed Position Spare 3 (RDSM - 165, CDD - 10)

CDD-11 Azimuth Defined Normal Slew Rate (RDSM - 166, CDD - 11)

CDD-12 Azimuth Defined Asynchronous Scan Rate (RDSM - 167, CDD - 12)

CDD-13 Azimuth Defined Synchronous Scan Rate (RDSM - 168, CDD - 13)

CDD-14 Azimuth Position Error (RDSM -

CDD-15 DAP Minimum Execution Time (RDSM - 145, CDD - 15)

CDD-16 DAP Maximum Execution Time (RDSM - 147, CDD - 16)

CDD-17 ICP Minimum Execution Time (RDSM - 210, CDD - 17)

CDD-18 ICP Maximum Execution Time (RDSM - 212, CDD - 18)

CDD-19 Instrument ID Number (CDD - 19) -

This parameter indicates the instrument's model identification reference. The enumerated values are in Table 4-19, note 120.

CDD-20 Packet Data Indicator (CDD - 20) -

This parameter indicates the type of data in the current packet generated by the instrument. Controlled by the SET_SCIENCE_PACKET_TYPE command, this parameter sets both the byte format of the 660 data records and sets the APID type. The enumerated values are in Table 4-19, note 119 . The APIDs are set as shown in Table 4-32:

Table 4-32. APID and Packet Format

Packet Data Type	Input Level-0 Data File		
	Science	Calibration	Diagnostic
Normal_Science	X		
Calibration		X	
Memory_Dump			X
Gimbal_Error			X
Execution_Time			X
Fixed_Pattern			X
No_Archive			X

CDD-21 Packet Data Version (CDD - 21) -

This parameter indicates the flight code version burned into the Instrument's PROMs. For the CERES instrument on the TRMM spacecraft, the default value = 4.

CDD-22 Science Packet Quick Look Flag Status (CDD - 22) -

This parameter indicates to the ground data processing system that a copy of a packet is to be made and collected into a level-0 file for quick-look science data processing. The enumerated values are in Table 4-19, note 137. For the CERES instrument on the TRMM spacecraft, this value is expected to be = Flag_Not_Set (normal condition). This parameter reflects the SET_QUICKLOOK_FLAG command.

CDD-23 Packet Timecode Indicator (CDD - 23) -

This parameter indicates whether the time stamp for a packet was generated from the spacecraft time-mark or from the instruments internal timer. The spacecraft derived time stamp is computed from the 1 Hz mark as:

#usec adjust = (659-sample# when tick occurred)*10000 ?????

The instrument time is put into the time stamp when 3 (TBR) time marks are missed.

CDD-24 Packet Counter - Relative (CDD - 24) -

This parameter indicates a 16 bit counter that is incremented for every CCSDS packet generated by the instrument. This will begin with the first packet generated after power-up or a "reset". Due to the synchronization process during power up, the first packet (0) will most likely be garbage data.

CDD-25 Packet Counter - Absolute (CDD - 25) -

This parameter indicates a 16 bit counter that is incremented for every CCSDS packet generated by the instrument. This will begin with the first packet generated after power-up or a “reset”. Due to the synchronization process during power up, the first packet (0) will most likely be garbage data.

Table 4-33. Analog Parameter Submultipliexer Channels

DAA Analog Parameters	Submux Channel	ICP Analog Parameters	Submux Channel
SPS_1_NARROW_FOV_OUTPUT	196	AZIMUTH_BRAKE_POSITION	163
SPS_1_WIDE_FOV_OUTPUT	197	AZIMUTH_LOWER_BEARING_TEMP	106
SPS_2_NARROW_FOV_OUTPUT	198	ACA_ELECTRONICS_TEMP	104
SPS_2_WIDE_FOV_OUTPUT	199	ACA_TORQUE_OUTPUT	162
MAIN_COVER_POSITION_1	166	ACA_ENCODER_CLEAR_TRACK_A	164
MAIN_COVER_POSITION_2	167	ACA_ENCODER_CLEAR_TRACK_B	165
MAM_COVER_POSITION	163	ECA_TORQUE_OUTPUT	0
MAIN_COVER_MOTOR_TEMP	107	ECA_ENCODER_CLEAR_TRK_CORSE	32
TOTAL_DETECTOR_CONTROL_TEMP	32	ECA_ENCODER_CLEAR_TRK_FINE	64
TOTAL_DETECTOR_MONITOR_TEMP	0	ICA_PROM_ELECTRONICS_TEMP	109
SW_DETECTOR_CONTROL_TEMP	34	ICA_ADC_ELECTRONICS_TEMP	111
SW_DETECTOR_MONITOR_TEMP	2	PCA_ELECTRONICS_TEMP	98
WN_DETECTOR_CONTROL_TEMP	33	ICA_SPARE_CHANNEL_1	96
WN_DETECTOR_MONITOR_TEMP	1	PEDESTAL_TEMP_ICA_RADIATOR	97
SENSOR_ELECTRONICS_TEMP	121	PEDESTAL_TEMP_1_RADIATOR	99
SENSOR_MODULE_TEMP	120	PEDESTAL_TEMP_2_ISOLATOR	100
ELEVATION_SPINDLE_TEMP_MOTOR	123	ICA_SPARE_CHANNEL_2	102
ELEVATION_SPINDLE_TEMP_CW	122	ICA_SPARE_CHANNEL_3	103
ELEVATION_BEARING_TEMP_CW	102	PEDESTAL_TEMP_PCA_RADIATOR	105
ELEVATION_BEARING_TEMP_MOTOR	106	ICA_PLUS_5V_DIGITAL	130
ECA_ELECTRONICS_TEMP	104	ICA_PLUS_15V_TO_ECA_ACA	132
ECA_RADIATOR_TEMP	105	ICA_MINUS_15V_TO_ECA_ACA	133
SPARE_CHANNEL_1	64	ICA_PLUS_5V_TO_DAA	128
SPARE_CHANNEL_2	65	ICA_PLUS_10V_TO_DAA	129
SPARE_CHANNEL_3	66	ICA_PLUS_15V_INTERNAL	134
SPARE_CHANNEL_4	67	ICA_MINUS_15V_INTERNAL	135
TOTAL_BLACKBODY_TEMP	224	RESERVED_FOR_DAA_DATA	253
WN_BLACKBODY_TEMP	225	RESERVED_FOR_DAA_DATA	254
SWICS_PHOTODIODE_TEMP	103	ICA_SPARE	255

Table 4-33. Analog Parameter Submultipliexer Channels

DAA Analog Parameters	Submux Channel	ICP Analog Parameters	Submux Channel
SWICS_PHOTODIODE_OUTPUT	226		
SWICS_LAMP_CURRENT	227		
MAM_TOTAL_BAFFLE_TEMP_1	96		
MAM_TOTAL_BAFFLE_TEMP_2	97		
AZIMUTH_UPPER_BEARING_TEMP	98		
SPARE_CHANNEL_5	99		
MAM_ASSEMBLY_SW_TEMP	100		
MAM_ASSEMBLY_TOTAL_TEMP	101		
DAA_CPU_ELECTRONICS_TEMP	108		
DAA_ADC_ELECTRONICS_TEMP	111		
DAA_RADIATOR_TEMP	112		
DETECTOR_POSITIVE_120V_BIAS	228		
DETECTOR_NEGATIVE_120V_BIAS	229		
DAA_PLUS_5V_DIGITAL	128		
DAA_PLUS_10V_REFERENCE	129		
SPARE_CHANNEL_6	130		
DAA_MINUS_10V_REFERENCE	131		
SEA_PLUS_15V_ANALOG	132		
SEA_MINUS_15V_ANALOG	133		
DAA_PLUS_15V_ANALOG	134		
DAA_MINUS_15V_ANALOG	135		
DAA_PLUS_130V	160		
DAA_MINUS_130V	161		
DAA_ANALOG_GROUND_REF_1	230		
DAA_ANALOG_GROUND_REF_2	231		
TOTAL_CHAN_HEATER_DAC_VALUE	250		
SW_CHAN_HEATER_DAC_VALUE	251		
WN_CHAN_HEATER_DAC_VALUE	252		
BLACKBODY_HEATER_DAC_VALUE	253		
RESERVED_FOR_USE_BY_THE_ICA	254		
DAA_SPARE	255		

Count Conversion Constants - This data set contains values that are used in various computations such as the radiometric count conversion algorithms for computing the radiances included in this data product.

Table 4-34. Count Conversion Constants

Link	Field No.	Field Names / Parameters	Data Type	Coefficients/Labels	Range	No. of Com-ponents
CCC-1	1	SW Channel Gain Coefficients	32-Bit Float	AV, AVA, AHA, AD, C	N/A	6
CCC-2	2	WN Channel Gain Coefficients	32-Bit Float	AV, AVA, AHA, AD, C	N/A	6
CCC-3	3	Total Channel Gain Coefficients	32-Bit Float	AV, AVA, AHA, AD, C	N/A	6
CCC-4	4	SW Channel 2nd Time Constants	32-Bit Float	Lambda, Chi	N/A	2
CCC-5	5	WN Channel 2nd Time Constants	32-Bit Float	Lambda, Chi	N/A	2
CCC-6	6	Total Channel 2nd Time Constants	32-Bit Float	Lambda, Chi	N/A	2
CCC-7	7	SW Radiance Edit Limits	32-Bit Float	Min, Max	N/A	2
CCC-8	8	WN Radiance Edit Limits	32-Bit Float	Min, Max	N/A	2
CCC-9	9	Total Radiance Edit Limits	32-Bit Float	Min, Max	N/A	2

CCC-1 SW Channel Gain Coefficients

CCC-2 WN Channel Gain Coefficients

CCC-3 Total Channel Gain Coefficients

CCC-4 SW Channel 2nd Time Constants

CCC-5 WN Channel 2nd Time Constants

CCC-6 Total Channel 2nd Time Constants

CCC-7 SW Radiance Edit Limits

CCC-8 WN Radiance Edit Limits

CCC-9 Total Radiance Edit Limit

4.3.3 Fill Values

Table 4-35 lists the default CERES Fill Values. These are used when data are missing, when there is insufficient data to make a calculation, or the data are suspect and there is no quality flag associated with the parameter. A value which has a corresponding flag need not be set to the CERES default value when the data value is suspect. Suspect values are values that were calculated but failed edit checks. The CERES default fill values are defined as follows:

Table 4-35. CERES Fill Values

Fill Value Name	Value	Fill Value Description
INT1_DFLT	127	default value for a 1-byte integer

Fill Value Name	Value	Fill Value Description
INT2_DFLT	32767	default value for a 2-byte integer
INT4_DFLT	2147483647	default value for a 4-byte integer
REAL4_DFLT	3.4028235E+38	default value for a 4-byte real
REAL8_DFLT	1.7976931348623157E+308	default value for a 8-byte real

5.0 Data Organization

All of the BDS data use Hierarchical Data Format (HDF) structures such as Vdata and Scientific Data Sets (SDSs). See the HDF User's Guide for additional information (Reference 4). Metadata for the BDS is implemented using the ECS Toolkit metadata routines (Reference 3), which are based on HDF Annotations.

The general composition of a BDS (for all collections) in terms of HDF components is as follows:

Data Structure	HDF Component
• Metadata	HDF Annotations
• Unconverted Science Data	HDF SDS(s)
• Unconverted Instrument Data	HDF Vdata(s)
• Digital Instrument Data	HDF SDS
• Converted Science Data	HDF SDS(s)
• Converted Instrument Data	HDF Vdata(s)
• Satellite-Celestial Data	HDF Vdata(s)
• Computation Parameters	HDF SDSs and Vdatas

5.1 Data Granularity

All BDS HDF data granules consist of no more that one hour of data from one CERES instrument for any APID. Recall that there could be 1 to 3 different BDS depending on the APID within a 24-hour period.

5.2 Data Format

All CERES BDS data granules are stored in Hierarchical Data Format (HDF) format.

6.0 Theory of Measurements and Data Manipulations

6.1 Theory of Measurements

See CERES ATBD 1.0. (Reference 2)

6.2 Data Processing Sequence

The Instrument Subsystem (1.0) produces validated Level 1-B geolocated radiance data from the raw Level 0 CERES instrument data. It reads and processes all science, calibration, and diagnostic data packets produced from CERES instruments on both the TRMM and the EOS platforms. For detailed information, see the Design Document (Reference 6).

The BDS data products are produced by the following major steps:

1. Read and unpack the raw Level-0 data.
2. Convert the engineering data to engineering units.
3. Edit-check the instrument and housekeeping parameters and report instrument anomalous behaviors and set quality flags.
4. Collect raw space look count data sets for all channels for each scan profile type, calculate the space clamp values and space clamp statistics for QA purposes.
5. Using elevation and azimuth angle data, adjust for any pointing misalignment and PSF lag and calculate the instrument pointing vectors.
6. Call the EOSDIS Toolkit to compute geolocation parameters and solar angles.
7. Read ancillary files needed for the radiance calculations. These include the count conversion offsets and coefficients.
8. Calculate the radiance values from the Level 0 raw count data and ancillary data.
9. Apply the 2nd time-constrant algorithm to compensate for the radiance count errors for the Total, Longwave, and Shortwave channels due to the instrument detectors' slow response times.
10. Range check the radiance values and set quality flags.
11. Output HDF structures to the BDS data product.

For detailed information see the Subsystem Architectural Design Document. (Reference 6)

6.3 Special Corrections/Adjustments

Algorithms not discussed in the ATBD are discussed in this section.

6.3.1 The spaceclamp algorithm - bridge balancing

6.3.2 2nd time constant algorithm

6.3.3 Point spread Function (PSF) lag algorithm

6.3.4 Cone and clock angle algorithms

6.3.5 Edit-limit and rate checks

7.0 Errors

See CERES ATBD 1.0. (Reference 2).

7.1 Quality Assessment

Quality Assessment (QA) activities are performed at the Science Computing Facility (SCF) by the Data Management Team. Processing reports containing statistics and processing results are examined for anomalies. If the reports show anomalies, data visualization tools are used to examine those products in greater detail to begin the anomaly investigation. See the QA flag descriptions for this product listed in Table 4-11 - Table 4-13.

7.2 Data Validation by Source

See Subsystem 1.0 Validation Docunent (Reference 7).

8.0 Notes

Note-1 Calibration Processing Concepts

The CERES scanner samples the incident radiance at a rate of 660 samples per second, so if m is the sensor measurement (in counts) and i is the pixel number, then:

$$m_i, i = 1, 2, \ldots, 660$$

represents the measurement value, and the radiance (L) for any pixel in the scan (assuming that the instrument is free of offsets due to either elevation or azimuth angle) and the radiance can be written:

$$L_i = \frac{A_v}{V_b} \cdot [m_i - m_{space}] - B$$

where:

$$A_v = \frac{1}{511.875 \bullet G_e \bullet A\Omega \bullet R_0 \bullet V_b / V_0}$$

and where:

Ge = Electronics gain (volts/volt)
AW = Telescope throughput (m2-sr)

R0 = Nominal responsivity
V0 = Nominal bias voltage
Vb = Actual bias voltage

In orbit, we use the mean “space-clamp” value for normalizing measurements to “cold” space:

$$\bar{m}_{space} = \frac{\bar{m}_{sb} - \bar{m}_{sa}}{2}$$

where:

msb is the mean of the pixels of space before the scan
msa is the mean of the pixels of space after the scan

Now,

$$\bar{m}_{sb} = \frac{\sum_{i=n_1}^{n_2} m_i}{n_2 - n_1 + 1}$$

and,

$$\bar{m}_{sa} = \frac{\sum_{i=n_3}^{n_4} m_i}{n_4 - n_3 + 1}$$

where:

n1 is the number of the first sample of space before scan
n2 is the number of the last sample of space before scan
n3 is the number of the first sample of space after scan
n4 is the number of the last sample of space after scan

and;

$$\bar{m}_{bb} = \frac{\sum_{i=n_5}^{n_6} m_i}{n_6 - n_5 + 1}$$

where:

n5 is the number of the first sample of ICSBB before scan
n6 is the number of the last sample of ICSBB before scan

[NOTE: While n5 and n6 will remain fixed for all CERES, n1through n4 will vary with the particular spacecraft, because they are altitude dependent.]

For a given sensor at time t, using equations 1-15 through 1-21 of the CERES Algorithm Theoretical Basis Document (ATBD), we can write the measured filtered radiance value as:

$$L_{t-\gamma} = A_V \cdot (m_t - \overline{m}_{sb} - B) + \frac{t - t_k}{6.6} \cdot [A_S \cdot (\overline{m}_{sa} - \overline{m}_{sb}) +$$

$$A_H \cdot (T_{H_{sa}} - T_{H_{sb}}) + A_D \cdot (V_{D_{sa}} + V_{D_{sb}}) + A_B \cdot (V_{B_{sa}} - V_{B_{sb}})]$$

where:

$$t_k = t_{k+1} + \Delta t$$

and:

$$A_V = \frac{AV}{C \cdot V_{bias_t}}$$

$$A_S = \frac{AVA}{C \cdot V_{bias_t}}$$

$$A_H = \frac{AHA}{C \cdot V_{bias_t}}$$

$$A_D = \frac{AD}{C \cdot V_{bias_t}}$$

$$A_B = \frac{AB}{C \cdot V_{bias_t}}$$

Vbias is the detector bridge bias voltage at time t.

B is an offset dependent on the scan geometry.

g is the average time lag between the instantaneous detector optical field of view and the point spread function centroid.

NOTE: AV, AHA, AVA, AD, and AB are constants delivered by TRW. They will be determined using the PFM ground calibration data.

NOTE-2 “Instantaneous” Blackbody Scanner Offset Calibrations (ICAL’s)

At the mid-point (time-wise) of the scan, the CERES sensors view the ICSBB for (n6 - n5 +1) pixels. It is possible to calculate the mean radiant emittance of the blackbody (Lbb) for these pixels, and then use the mean to correct the offset for the scan;

We would then have an offset B, represented by:

$$L_{bb} = \frac{\varepsilon\delta \sum_{i=n_5}^{n_6} T_i^4}{n_6 - n_5 + 1}$$

$$B = \frac{A_V}{V_B} \cdot \frac{\sum_{i=n_1}^{n_2} (m_i - m_{space})}{n_2 - n_1 + 1} - L_{bb}$$

Likewise, for any pixel i observed when the local solar zenith angle (at the TOA) exceeds ~123 degrees, will be in total darkness, and the shortwave radiance for that pixel may be assumed to be zero, permitting us to write:

$$B_{SW_i} = (m_i - m_{space}) \cdot \frac{A_V}{V_b}$$

NOTE-3 Flight (Orbital) Data Conversion

The conversion from monitor element resistances to engineering units for TRMM are governed by the following algorithms, as described in TRW DRL-64, Revision E, dated 18 March 1997.

1. Algorithm 1 - For the blackbody PRT channels:

$$Tprt = 3392.2 - \sqrt{(1.3208 \times 10^7 - 849.31 \bullet Rt)}$$

where:

$$R_t = \frac{14784.25 + counts}{7.859547 - 5 \times 10^{-5} \bullet counts}$$

2. Algorithm 2 - For the Sensor Control Temperature channels:

$$Tsct_\lambda = \frac{R_{t_\lambda} - C_\lambda}{D_\lambda}$$

where:

Table 8-1. Algorithm 2 Temperature Coefficients

λ	C_λ	D_λ
Total	860.85	4.5525
Longwave	862.30	4.4925
Shortwave	865.16	4.179167

and where:

$$R_{t_\lambda} = \frac{E_\lambda + counts}{F_\lambda - G_\lambda \cdot counts}$$

and:

Table 8-2. Algorithm 2 Count Coefficients

λ	E_λ	F_λ	G_λ
Total	275520.4	269.021132	$2*10^{-4}$
Longwave	275520.4	269.021132	$2*10^{-4}$
Shortwave	275520.4	271.471234	$2.018*10^{-4}$

3. Algorithm 3 - For the general thermistor temperature monitors:

$$Tttc = \frac{7.8431\times10^{6}}{(7.3365\times10^{3} + 1.7341\times10^{3} \bullet \log Rt + \log^{3} Rt)} - 273.15$$

where:

Algorithm 3A (Detector Monitors):

$$R_t = \frac{27405.4 + counts}{1.702397 + 1\times10^{-5} \bullet counts}$$

Algorithm 3B - (SEA Thermistors):

$$R_t = \frac{273.72995 + counts}{04290979 + 8.264\times10^{-6} \bullet counts}$$

Algorithm 3C - (General Temperature Monitors):

$$R_t = \frac{273.72995 + counts}{04290979 + 8.264 \times 10^{-6} \bullet counts} - 1200.$$

4. Algorithm 4 - Linear Conversions:

$$Data = m \bullet counts + b$$

where:

Table 8-3. Algorithm 4 Linear Coefficients

Sub-Type	Slope (m)	Intercept (b)	Units
A	0.004884	0	Volts
B	0.005861	-20	Volts
C	0.060048	0	Volts
D	0.003995	-135.819	Volts
E	0.002442	115.001	Volts
F	0.002442	-125.000	Volts
G	0.003907	0.0	Volts
H	0.046617	-95.712	in-oz.
I	0.129861	-266.625	in-oz.
J	0.0019536	0	Volts
K	0.0054932	0	Degrees
L	0.028145	0	mA
M	6.6	0	sec
N	0.001	0	msec
O	0.00293	0	Volts

5. Algorithm 5 - Solar Aspect Sensor (N/A).

6. Algorithm 6 - Solar Presence Sensor:

7. Algorithm 7 - Gimbal Rate (in deg/sec):

$$Rate = \frac{5493.1641}{counts + 2}$$

8. Algorithm 8 - Sensor Response (in Watts/m2-sr):

$$\Delta L = \frac{counts}{511.875 \bullet Ge \bullet R_b \bullet A\Omega}$$

where: DL = Filtered Radiance
Ge = Electronics Gain (Volts/Volt)
Rb = Detector Responsivity = R0 * Vb/V0
Vb = Actual bias voltage
V0 = Nominal bias voltage
R0 = Nominal responsivity (W/m2-sr)
AW = Telescope Throughput (m2-sr)

NOTE-4 Flight Code Heater Algorithm

The control of the detector channel heatsinks and the blackbody temperatures are governed by the following algorithms, as described in TRW DRL-87 (Reference 9), dated 11 January 1996.

$$DACValue = \frac{(\sqrt{power(t) - C0}) \times C1}{C2}$$

where:

$$Power(t) = Part1 + Part2$$

$$Part1 = (A0 \times error(t) + A1 \times error(t-1))$$

$$Part2 = \frac{\left(\frac{\left(\left(\left(\frac{power(t-1)}{4095}\right) \times 8192\right) \times B1\right)}{4095}\right)}{8} = \frac{(power(t-1) \times 2 \times B1)}{511.875}$$

and:

$$error(t) = (SetpointTemp - ControlTemp) + ScaledTempError$$

$$ScaledTempError = \frac{(IntegratedError(t) + IntegratedError(t-1))}{262144}$$

$$IntegratedError(t) = D0 \times (error(t) + error(t-1))$$

$$error(t) = MonitorTemp(t) - (4095 - SetpointTemp)$$

for: t = current sample value, t-1 = previous sample value.
:

Table 8-4. Heater Control Algorithm Default Coefficient Values

Heater	A0	A1	B1	C0	C1	C2	D0
Sensors	29761	-29266	-16367	991	100	119	54
Blackbody	17468	0	0	0	15000	1414	0

NOTE-5 Flight Code Memory Patches

Each instrument has additional memory patches that are loaded into the instrument after every power-up, commanded reset, or watchdog time-out reset. Currently, the CERES instrument for the TRMM observatory has the following patches (in their order of loading), along with the expected resulting microprocessor checksum.

Note: The baseline (ROM) code checksums for the PFM Instrument are: DAP = 24364 (5F2C) and ICP = 60704 (ED20).

Table 8-5. PFM (TRMM) Memory Patch Loads

Item #	Patch Name	Check-Sum Values in DEC (HEX)	Patch Description
1	HKPATCH1.MDF	60830 (ED9E)	Sets the HK command error to be the most recent rather than the oldest error.
2	ICPHLT0.MDF	52758 (CE16)	Fixes an ICP spacecraft Time Mark Halt collision handler.
3	DAPSCKL0.MDF	11048 (2B28)	Fixes a 100Hz timing interrupt service routine.

Table 8-5. PFM (TRMM) Memory Patch Loads

Item #	Patch Name	Check-Sum Values in DEC (HEX)	Patch Description
4	DAPSCLK1.MDF	29832 (7488)	Patches the interrupt vector table for the new interrupt service function (DAPSCKL0)
5	ICPSCLK0.MDF	58175 (E33F)	The ICP version of the DAPSClK0 patch.
6	ICPSCKL1.MDF	11345 (2C51)	The ICP version of the DAPSCLK1 patch.

Table 8-6. FM1 (EOS-AM) Memory Patch Loads

Item #	Patch Name	Check-Sum Values in DEC (HEX)	Patch Description
1	HKPATCH1.MDF	60830 (ED9E)	Sets the HK command error to be the most recent rather than the oldest error.
2	ICPHLT0.MDF	52758 (CE16)	Fixes an ICP spacecraft Time Mark Halt collision handler.
3	XXXX.MDF	####	RESERVED

Table 8-7. FM2 (EOS-AM) Memory Patch Loads

Item #	Patch Name	Check-Sum Values in DEC (HEX)	Patch Description
1	HKPATCH1.MDF	60830 (ED9E)	Sets the HK command error to be the most recent rather than the oldest error.

9.0 Application of the Data Set

The BDS product provides the instantaneous geolocated radiometric data for the ERBE-like Subsystems.

10.0 Future Modifications and Plans

11.0 Software Description

There is a C read program that interfaces with the HDF libraries and a Read Me file available from the LaRC DAAC User Services. The program was designed to run on an Unix workstation and can be compiled with a C compiler.

12.0 Data Access

12.1 Contacts for Data Center/Data Access Information

EOSDIS Langley DAAC
NASA Langley Research Center
Mail Stop 157D
2 South Wright Street
Hampton, VA 23681-2199
USA
Telephone: (757) 864-8656
FAX: (757) 864-8807
E-mail: larc@eos.nasa.gov
URL:

12.2 Data Center Identification

EOSDIS Langley DAAC
NASA Langley Research Center
Hampton, Virginia 23681-2199

12.3 Procedures for Obtaining Data

{Section supplied by the DAAC}

13.0 Output Products and Availability

{Section supplied by the DAAC - includes packaging for distribution}

14.0 References

1. Clouds and the Earth's Radiant Energy System (CERES) Data Management System Data Products Catalog Release 3 Version 1 February 1998 {URL = http://asd-www.larc.nasa.gov/DPC/DPC.html}

2. Clouds and the Earth's Radiant Energy System (CERES) Algorithm Theoretical Basis Document, Instrument Geolocate and Calibrate Earth Radiances (Subsystem 1.0), Release 2.2, June 1997 {URL = http://asd-www.larc.nasa.gov/ATBD/ATBD.html}

3. Release A SCF Toolkit User's Guide for the ECS Project, November 1996

4. HDF User's Guide, Version 4.0, February 1996 (from NCSA)

5. Software Bulletins Web Page {URL = http://asd-www.larc.nasa.gov/ceres/bulletins.html}

6. Instrument Geolocate and Calibrate Earth Radiances (Subsystem 1.0) Architectural Draft Design Document Release 1.0, June 1996 {URL = http://asd-www.larc.nasa.gov/SDD/SDD.html}

7. CERES Geolocate and Calibrate Earth Radiances Level 1 Instrument Science Data Validation and Consistency Plan, Release 1.1, March 1996 {URL = http://asd-www.larc.nasa.gov/validation/valid_doc.html}

8. TRW DRL 64, 55067.300.008D; In-flight Measurement Analysis (Revision D); 12 September 1995

9. TRW DRL 87,

15.0 Glossary of Terms

16.0 List of Acronyms

ADM	Angular Distribution Model
APD	Aerosol Profile Data
ATBD	Algorithm Theoretical Basis Document
AVG	Monthly Regional Radiative Fluxes and Clouds
AVHRR	Advanced Very High Resolution Radiometer
BDS	Bidirectional Scan
CADM	CERES Angular Distribution Model
CERES	Clouds and the Earth's Radiant Energy System
CID	Cloud Imager Data
CRH	Clear Reflectance History
CRS	Clouds and Radiative Swath
DAAC	Distributed Active Archive Center
DAO	Data Assimilation Office
DMS	Data Management System
EDDB	ERBE-Like Daily Database Product

EOS	Earth Observing System
EOS-AM	EOS Morning Crossing (Ascending) Mission
EOS-PM	EOS Afternoon Crossing (Descending) Mission
EOSDIS	Earth Observing System Data and Information System
ERBE	Earth Radiation Budget Experiment
ERBS	Earth Radiation Budget Satellite
FOV	Field-of-View
FSW	Monthly Single Satellite Fluxes and Clouds
GAP	Gridded Analysis Product
GB	Giga Byte
GEO	Geostationary Narrowband Radiances
GGEO	Gridded GEO Narrowband Radiances
GMS	Geostationary Meteorological Satellite
GOES	Geostationary Operational Environmental Satellite
H	High
HDF	Hierarchical Data Format
IES	Instrument Earth Scans
IGBP	International Geosphere Biosphere Programme
IMS	Information Management System
INSTR	Instrument
ISCCP	International Satellite Cloud Climatology Project
IWC	Ice Water Content
LaRC	Langley Research Center
L	Low
LM	Lower Middle
LW	Longwave
LWC	Liquid Water Content
MB	Mega Byte
METEOSAT	Meteorological Satellite
MISR	Multi-angle Imaging SpectroRadiometer
MOA	Meteorological, Ozone, and Aerosols
MODIS	Moderate Resolution Imaging Spectrometer
MWH	Microwave Humidity
NASA	National Aeronautics and Space Administration
NOAA	National Oceanic and Atmospheric Administration
OPD	Ozone Profile Data
PSF	Point Spread Function
QA	Quality Assessment
RAPS	Rotating Azimuth Plane Scan
SARB	Surface and Atmospheric Radiation Budget
SBUV-2	Solar Backscatter Ultraviolet/Version 2
SFC	Monthly Gridded Single Satellite TOA and Surface Fluxes and Clouds
SRB	Surface Radiation Budget
SRBAVG	Monthly Averages for Top-of-Atmosphere and Surface Radiation Budget
SSF	Single Satellite CERES Footprint TOA and Surface Fluxes, Clouds
SSM/I	Special Sensor Microwave/Imager

SURFMAP	Surface Map
SW	Shortwave
SYN	Synoptic Radiative Fluxes and Clouds
TBD	To be determined
TISA	Time Interpolation and Spatial Averaging
TMI	TRMM Microwave Imager
TOA	Top-of-the-Atmosphere
TRMM	Tropical Rainfall Measuring Mission
UM	Upper Middle
URL	Uniform Resource Locator
VIRS	Visible Infrared Scanner
WN	Window
ZAVG	Monthly Zonal and Global Radiative Fluxes and Clouds

Unit Definitions

Units	Definition
AU	Astronomical Unit
cm	centimeter
count	count, counts
day	day, Julian date
deg	degree
deg sec^{-1}	degrees per second
du	Dobson units
fraction	fraction 0..1
g kg^{-1}	gram per kilogram
g $^{m-2}$	gram per square meter
hhmmss	hour, minute, second
hour	hour
hPa	hectoPascals
in-oz	inch-ounce
K	Kelvin
km	kilometer, kilometers
km sec^{-1}	kilometers per second
m	meter
mA	milliamp, milliamps
micron	micrometer, micron
msec	millisecond
mW $cm^{-2} sr^{-1} \mu m^{-1}$	milliWatts per square centimeter per steradian per micron

Units	Definition
m sec^{-1}	meter per second
N/A	not applicable, none, unitless, dimensionless
percent	percent, percentage 0..100
rad	radian
sec	second
volt	volt, volts
W h m^{-2}	Watt hour per square meter
W^2 m^4	square Watt per meter to the 4th
W m^{-2}	Watt per square meter
W $m^{-2}sr^{-1}$	Watt per square meter per steradian
W $m^{-2}sr^{-1}\mu m^{-1}$	Watt per square meter per steradian per micron
°C	degrees centigrade
µm	micrometer, micron

17.0 Document Information

17.1 Document Revision Date

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17.2 Document ID

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17.3 Citation

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17.4 Document Curator

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17.5 Document URL

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APPENDIX A

CERES Metadata

This section describes the metadata that are written to all CERES HDF products, and are listed in Table A-1 and Table A-2. Table A-1 describes the CERES Baseline Header Metadata that are written on both HDF and binary direct access output science data products. The parameters are written in HDF structures for CERES HDF output products and are written as 80 byte records for binary direct access output products. Some parameters may be written in multiple records. Table A-2 describes the CERES_metadata Vdata parameters that are a subset of the CERES Baseline Header Metadata and are also written to all CERES HDF output products.

Table A-1 lists the item number, parameter name, units, range or allowable values, the data type, and the maximum number of elements. Note that there are two choices for parameters 22-25 and two choices for parameters 26-29. The choices depend on whether the product is described by a bounding rectangle or by a GRing. Abbreviations used in the Data Type field are defined as

s = string	date =	yyyy-mm-dd
F = float	time =	hh:mm:ss.xxxxxxZ
I = integer	datetime =	yyyy-mm-ddThh:mm:ss.xxxxxxZ

Table A-1. CERES Baseline Header Metadata

Item	Parameter Name	Units	Range	Data Type	No. of Elements
1	ShortName	N/A	N/A	s(8)	1
2	VersionID	N/A	0 .. 255	I3	1
3	CERPGEName	N/A	N/A	s(20)	1
4	SamplingStrategy	N/A	CERES, TRMM-PFM-VIRS, AM1-FM1-MODIS, TBD	s(20)	1
5	ProductionStrategy	N/A	Edition, Campaign, DiagnosticCase, PreFlight, TBD	s(20)	1
6	CERDataDateYear	N/A	1997 .. 2050	s(4)	1
7	CERDataDateMonth	N/A	1 .. 12	s(2)	1
8	CERDataDateDay	N/A	1 .. 31	s(2)	1
9	CERHrOfMonth	N/A	1 .. 744	s(3)	1
10	RangeBeginningDate	N/A	1997-11-19 .. 2050-12-31	date	1
11	RangeBeginningTime	N/A	00:00:00.000000Z .. 24:00:00:000000Z	time	1
12	RangeEndingDate	N/A	1997-11-19 .. 2050-12-31	date	1
13	RangeEndingTime	N/A	00:00:00.000000Z .. 24:00:00:000000Z	time	1
14	AssociatedPlatformShortName	N/A	TRMM, AM1, PM1, TBD	s(20)	1 - 4

Table A-1. CERES Baseline Header Metadata

Item	Parameter Name	Units	Range	Data Type	No. of Elements
15	AssociatedInstrumentShortName	N/A	PFM, FM1, FM2, FM3, FM4, FM5, TBD	s(20)	1-4
16	LocalGranuleID	N/A	N/A	s(80)	1
17	PGEVersion	N/A	N/A	s(10)	1
18	CERProductionDateTime	N/A	N/A	datetime	1
19	LocalVersionID	N/A	N/A	s(60)	1
20	ProductGenerationLOC	N/A	SGI_xxx, TBD	s(255)	1
21	NumberofRecords	N/A	1 .. 9 999 999 999	I10	1
22	WestBoundingCoordinate	deg	-180.0 .. 180.0	F11.6	1
23	NorthBoundingCoordinate	deg	-90.0 .. 90.0	F11.6	1
24	EastBoundingCoordinate	deg	-180.0 .. 180.0	F11.6	1
25	SouthBoundingCoordinate	deg	-90.0 .. 90.0	F11.6	1
22	GRingPointLatitude	deg	-90.0 .. 90.0	F11.6	5
23	GRingPointLongitude	deg	-180.0 .. 180.0	F11.6	5
24	GRingPointSequenceNo	N/A	0 .. 99999	I5	5
25	ExclusionGRingFlag	N/A	Y (= YES), N (= NO)	s(1)	1
26	CERWestBoundingCoordinate	deg	0.0 .. 360.0	F11.6	1
27	CERNorthBoundingCoordinate	deg	0.0 .. 180.0	F11.6	1
28	CEREastBoundingCoordinate	deg	0.0 .. 360.0	F11.6	1
29	CERSouthBoundingCoordinate	deg	0.0 .. 180.0	F11.6	1
26	CERGRingPointLatitude	deg	0.0 .. 180.0	F11.6	5
27	CERGRingPointLongitude	deg	0.0 .. 360.0	F11.6	5
28	GRingPointSequenceNo	N/A	0 .. 99999	I5	5
29	ExclusionGRingFlag	N/A	Y (= YES), N (= NO)	s(1)	1
30	AutomaticQualityFlag	N/A	Passed, Failed, or Suspect	s(64)	1
31	AutomaticQualityFlagExplanation	N/A	N/A	s(255)	1
32	QAGranuleFilename	N/A	N/A	s(255)	1
33	ValidationFilename	N/A	N/A	s(255)	1
34	ImagerShortName	N/A	VIRS, MODIS, TBD	s(20)	1
35	InputPointer	N/A	N/A	s(255)	800
36	NumberInputFiles	N/A	1 .. 9999	I4	1

Table A-2 describes the CERES_metadata Vdata parameters which are written to all CERES HDF output science products. The table lists the item number, parameter name, units, range or allowable values, and the parameter data type where

s = string	date =	yyyy-mm-dd
F = float	time =	hh:mm:ss.xxxxxxZ
I = integer	datetime =	yyyy-mm-ddThh:mm:ss.xxxxxxZ

Table A-2. CERES_metadata Vdata

Item	Parameter Name	Units	Range	Data Type
1	ShortName	N/A	N/A	s(32)
2	RangeBeginningDate	N/A	1997-11-19 .. 2050-12-31	s(32)
3	RangeBeginningTime	N/A	00:00:00.000000Z .. 24:00:00:000000Z	s(32)
4	RangeEndingDate	N/A	1997-11-19 .. 2050-12-31	s(32)
5	RangeEndingTime	N/A	00:00:00.000000Z .. 24:00:00:000000Z	s(32)
6	AutomaticQualityFlag	N/A	Passed, Failed, or Suspect	s(64)
7	AutomaticQualityFlagExplanation	N/A	N/A	s(256)
8	AssociatedPlatformShortName	N/A	TRMM, EOS AM-1, EOS PM-1, TBD	s(32)
9	AssociatedInstrumentShortName	N/A	PFM, FM1, FM2, FM3, FM4, FM5, TBD	s(32)
10	LocalGranuleID	N/A	N/A	s(96)
11	LocalVersionID	N/A	N/A	s(64)
12	CERProductionDateTime	N/A	N/A	s(32)
13	NumberofRecords	N/A	1 .. 9 999 999 999	4-byte integer
14	ProductGenerationLOC	N/A	SGI_xxx, TBD	s(256)